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ERRATA

NSA, Vol. 6, No. 10, index p.6. In the Numerical Index of Reports, NYO-1514 should be NYO-3045; its abstract number 5-659 should read 6-1514.

NSA, Vol. 6, No. 11, p.425. At the end of the title listing, abstract 3404, the report number should be CF-51-5-113, Lecture I, rather than CF-51-11-113, Lecture I.

NSA, Vol. 6, No. 15, Supplement p.1. For $_{12}Mg^{24}_{12}$ the proton energy should be E_p, not E_t.

NSA, Vol. 6, No. 17, p.619. In the title of abstract 5066, NUCLEAR REACTIONS should read NUCLEAR REACTORS.

NSA, Vol. 6, No. 17, p.625. In abstract 5117, the word radium should be replaced by sodium each time it appears in the text (lines 1, 4, 7, and 8).

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The abstract number for each report is listed at the upper right of the entry. If the number bears an asterisk, the report is title listed only and no abstract is included.

U. S. ATOMIC ENERGY COMMISSION DECLASSIFIED REPORTS

AECD-3433 5764
Los Alamos Scientific Lab.
EQUILIBRIA AND REACTION RATES IN THE DISPROPORTIONATION OF Pu(IV), by Sherman W. Rabideau. [nd] Decl. Aug. 26, 1952. 17p. (AECD-3433; LADC-1199)

AECD-3434 5911
Los Alamos Scientific Lab.
SOFT RADIATION FROM Pu^{239}, by Harvey I. Israel. [nd] Decl. Aug. 26, 1952. 4p. (AECD-3434; LADC-1236)

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A LOW COST EXPERIMENTAL NEUTRON CHAIN REACTOR; PART I, by William M. Breazeale. Issued Apr. 15, 1952. Decl. Aug. 13, 1952. 58p. (AECD-3435; ORNL-1105(Rev.))

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THE THERMAL NEUTRON CAPTURE CROSS-SECTIONS OF Pa^{231} AND Pa^{233}, by R. Elson, P. A. Sellers, and E. R. John. June 1952. Decl. Aug. 28, 1952. 3p. (AECD-3436; ANL-WMM-990)

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THE VOLUMETRIC DETERMINATIONS OF URANIUM(VI) IN PHOSPHATE SOLUTIONS, by J. M. Schreyer and C. F. Baes, Jr. [nd] Decl. Aug. 27, 1952. 9p. (AECD-3438; ORNL-1292)

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CONCERNING THE POSSIBLE OCCURRENCE OF Si^{32} IN NATURE, by A. Turkevich and A. Tompkins. June 1951. Argonne National Lab. and Institute of Nuclear Studies, Univ. of Chicago. Decl. with deletions Aug. 27, 1952. 2p. (AECD-3439; ANL-WMM-945)

AECD-3440 5757
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THE EXTRACTION OF COBALT FROM NICKEL IN A PULSE COLUMN (thesis), by William L. Griffith, George R. Jasny, and Howard T. Tupper. 1952. Decl. Aug. 22, 1952. 95p. (AECD-3440; KT-114)

AECD-3441 5770
Carbide and Carbon Chemicals Co. (K-25)
MAGNETIC PUMPS FOR CORROSIVE GASES AND LIQUIDS, by F. D. Rosen. Issued Oct. 31, 1951. Decl. with deletions Aug. 28, 1952. 11p. (AECD-3441; K-833)

AECD-3442 5813
Los Alamos Scientific Lab.
TRANSIENT PRESSURE RECORDING WITH A HIGH SPEED INTERFEROMETER CAMERA, by Willard E. Buck. [nd] Decl. with deletions Aug. 28, 1952. 19p. (AECD-3442; LADC-1213)

AECD-3443 5744
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A STUDY OF ELECTRIC POWER GENERATION UTILIZING HEAT ENERGY FROM POWER BREEDER REACTORS, by R. H. Shannon, J. D. Selby, and M. B. Dagan. Nov. 19, 1951. Decl. Aug. 27, 1952. 45p. (AECD-3444; KAPL-591)

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CINEMATOGRAPHY OF BINUCLEATE CELL FORMATION IN MELANOPLUS DIFFERENTIALIS SPERMATOCYTES, by T. N. Tahmisian and A. M. Brues. July 1952. 1p. (AECU-2202; UAC-597)

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RUBBER HYDROCHLORIDE FILM AS A REPLACEMENT FOR NYLON FILM FOR RADIATION DETECTING INSTRUMENTS, by W. B. Leslie. Aug. 12, 1952. 4p. (AECU-2205; Technical Memorandum No. 5-52-15)

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HOT LABORATORY TECHNICAL REPORT. V. SMALL CORROSION-RESISTANT VALVES FOR REMOTE CHEMICAL SERVICE, by Gerald J. Selvin. May 1, 1952. 8p. (BNL-186)

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DESIGN OF PERCOLATORS, by S. H. Jury. July 9, 1951. 25p. (CF-51-7-41)

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A MULTICHANNEL PULSE HEIGHT ANALYSIS SYSTEM UTILIZING PHOTOGRAPHIC RECORDING ON 35mm. FILM, by D. J. Zaffarano, F. L. Boley, and W. A. Hunt. Aug. 4, 1952. 27p. (ISC-253)

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THE INFRARED SPECTRA OF AROMATIC COMPOUNDS. I. EVIDENCE FOR INTRAMOLECULAR HYDROGEN BONDING BETWEEN SUBSTITUENT GROUPS AND RING HYDROGENS, by M. Margoshes and V. A. Fassel. Aug. 8, 1952. 20p. (ISC-259)

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SPECTROPHOTOMETRIC DETERMINATION OF THORIUM IN MONAZITE SANDS, by Charles V. Banks and Carol H. Byrd. Sept. 1, 1952. 24p. (ISC-263; LR-105)

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EFFICIENCY OF A HEAT EXCHANGER USING SQUARE FINS ON ROUND TUBES, by H. Zabronsky. Issued Aug. 15, 1952. 16p. (K-929)

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THE EFFECT OF HIGH-INTENSITY GAMMA RAYS ON THE OPTICAL TRANSMISSION OF CERIUM-STABILIZED GLASS, by E. L. Shirley and A. D. Aird. Aug. 14, 1952. 16p. (KAPL-759)

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ANNUAL PROGRESS REPORT FOR JUNE 1, 1951 — MAY 31, 1952 ON SPALLATION REACTIONS, by Wade Callender, Albert A. Caretto, Jr., Bruce Dropesky, Richard W. Fink, Alan A. Goerlitz, Clarence G. Heininger, Genevieve Wagner, and Edwin O. Wiig. [nd] 13p. (NYO-704)

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SOLID SOLUTIONS AND GRAIN BOUNDARIES; TECHNICAL PROGRESS REPORT NO. 12, SCOPE II, by L. L. Seigle, M. Cohen, and B. L. Averbach. Aug. 4, 1952. 37p. (NYO-3807)

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MAMMALIAN RADIATION GENETICS, by W. L. Russell. Issued Aug. 11, 1952. 16p. (ORNL-1337)

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ANNUAL REPORT FOR JULY 1, 1951 TO JUNE 30, 1952, PART I, [ON] NEW DATA ON SYNTHESES OF URANIUM MINERALS, by John W. Gruner. Issued July 1, 1952. 25p. (RMO-983)

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ALPHA PARTICLE INDUCED RADIATION IN THIN FILMS, by M. A. Greenfield, Amos Norman and Paul M. Kratz. Issued Aug. 22, 1952. 7p. (UCLA-218)

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THE USE OF A PHOTOMULTIPLIER SCINTILLATION TUBE AS A SAFEGUARD DEVICE FOR Co^{60} SOURCE, by Jacob E. Dietrich and William R. Kennedy. Issued Aug. 25, 1952. 9p. (UCLA-219)

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PHOTOPION PRODUCTION, by Richard Madey. June 27, 1952. 53p. (UCRL-1856)

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REACTIONS OF FAST CARBON NUCLEI IN PHOTOGRAPHIC EMULSIONS (thesis), by James Fuller Miller. July 1952. 258p. (UCRL-1902)

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SPARKING AND X-RAYS IN A MERCURY PUMPED VACUUM SYSTEM, by W. Kilpatrick. Aug. 1952. 15p. (UCRL-1907)

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INVESTIGATIONS OF ALPHA RADIOACTIVITY USING NUCLEAR EMULSIONS (thesis), by Dean Carl Dunlavey. Aug. 1952. 42p. (UCRL-1911)

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OTHER UNCLASSIFIED REPORTS OF SPECIAL INTEREST TO AEC LABORATORIES

AERE C/R-885 5736
Atomic Energy Research Establishment, Harwell, Berks (England)
THE DETERMINATION OF OXYGEN IN URANIUM OXIDES, by L. E. J. Roberts and E. A. Harper. May 5, 1952. 7p. (AERE C/R-885)

AERE C/R-898 5730
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CALCULATION OF THE ACTIVITY COEFFICIENTS OF MIXED AQUEOUS ELECTROLYTES FROM VAPOUR PRESSURES, by E. Glueckauf, H. A. C. McKay, and J. K. Perring. Apr. 24, 1952. 11p. (AERE C/R-898)

AERE C/R-930 5737
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THE DETERMINATION OF SMALL QUANTITIES OF URANIUM IN ROCKS AND MINERALS BY RADIOACTIVATION, by A. A. Smales. May 13, 1952. 18p. (AERE C/R-930)

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A MASS SPECTROMETER ION SOURCE FOR SOLID MATERIAL, by G. H. Palmer and K. L. Aitken. June 6, 1952. 10p. (AERE G/R-953)

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A NEW DESIGN OF FILTER FOR DRY-BOXES, TYPE D/47, by W. G. Busbridge. 1952. 5p. (AERE HP/M-34)

NBS-1753 5830
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QUARTERLY PROGRESS REPORT OF THE OFFICE OF BASIC INSTRUMENTATION, FOR THE QUARTER ENDING MARCH 31, 1952. [nd] 70p. (NBS-1753)

NP-3875 5751
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LABORATORY DESIGN FOR HANDLING RADIOACTIVE MATERIALS. RESEARCH CORRELATION CONFERENCE, NOVEMBER 27 AND 28, 1951. May, 1952. 140p. (NP-3875; Research Conference Report No. 3)

NP-3936 5855
Duke Univ.
QUARTERLY PROGRESS REPORT; MICROWAVE RESEARCH; FOR FEBRUARY 1, 1952–FEBRUARY 29, 1952, by Walter Gordy. [nd] 20p. (NP-3936)

NP-3980 5783
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SECOND INTERIM REPORT ON THE EFFECT OF MICROSTRUCTURE ON THE MECHANICAL PROPERTIES OF TITANIUM ALLOYS TO WATERTOWN ARSENAL, by F. C. Holden, D. J. Maykuth, H. R. Ogden and R. I. Jaffee. June 27, 1952. 37p. (NP-3980)

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RCA-Victor Div., Radio Corp. of America
RESEARCH INVESTIGATION OF IONIZATION CHAMBERS; FINAL REPORT FOR MAY 1, 1951–APRIL 30, 1952, by J. R. Parker. [nd] 159p. (NP-3984)

NP-4003 5746
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THE HEAT OF DISSOCIATION OF FLUORINE, by Russell N. Doescher. Nov. 2, 1951. 10p. (NP-4003; Report No. 20-61; ATI-133893)

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Research Lab. of Electronics, Mass. Inst. of Tech.
ZEEMAN-EFFECT MEASUREMENTS ON MICROWAVE SPECTRA; TECHNICAL REPORT NO. 225, by J. R. Eshbach and M. W. P. Strandberg. Feb. 4, 1952. 12p. (NP-4006; Technical Report No. 225; U23437)

NP-4007 5789
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QUARTERLY PROGRESS REPORT [FOR PERIOD ENDING JUNE 1, 1952], by J. B. Wiesner. July 15, 1952. 95p. (NP-4007; U23347)

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QUARTERLY PROGRESS REPORT NO. 10 [FOR] AUGUST 1951 TO OCTOBER 1951, by W. H. Pearlson. [nd] 71p. (NP-4039; Quarterly Progress Report No. 10)

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A COLORIMETRIC METHOD FOR THE DETERMINATION OF GERMANIUM IN BIOLOGICAL MATERIALS, by George Rosenfeld. Apr. 16, 1952. 16p. (NP-4042)

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STUDIES OF THE METABOLISM OF GERMANIUM, by George Rosenfeld. Apr. 16, 1952. 16p. (NP-4044)

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SORPTION OF GASES ON METAL POWDERS AND SUBSEQUENT CHANGE IN METAL REACTIVITY AT ROOM TEMPERATURE, by Hung Li Wang and Norman Hackerman. [nd] 19p. (NP-4046)

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PHARMACOLOGICAL STUDIES OF RADIOGERMANIUM (Ge^{71}), by H. C. Dudley, E. J. Wallace, and L. J. Louviere. May 29, 1952. 15p. (NP-4048)

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DECREASE OF N^{15}/N^{14} RATIO MEASUREMENT AS A FUNCTION OF PUMP-OUT TIME FOR THE NIER-TYPE ISOTOPE-RATIO MASS SPECTROMETER, by James Zorzy. Jan. 30, 1952. 12p. (NP-4049)

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A GLASS SLEEVE COUPLING, by Louis P. Cecchini. May 22, 1952. 6p. (NP-4050; Memorandum Report 52-6)

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WETTING OF SOLIDS AS INFLUENCED BY THE POLARIZABILITY OF SURFACE IONS, by W. A. Weyl. Sept. 30, 1952. 100p. (NP-4051)

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FINAL TECHNICAL REPORT [ON] RESEARCH AND DEVELOPMENT OF METHODS OF CHEMICAL ANALYSIS FOR TITANIUM METAL AND ITS ALLOYS AS PART "A" OF CHEMICAL ANALYSIS AND VAPOR DEPOSITED COATINGS FOR TITANIUM, by Dennis Ord. June 13, 1952. 51p. (NP-4052; WAL Report No. 401/48/A-12)

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ELECTRONIC CONCENTRATION WITH THE LAPOINTE PICKER BELT. PART 2. ELECTRICAL CIRCUITS FOR THE LAPOINTE PICKER, by R. D. Wilmot. July 3, 1952. 26p. (NP-4063; TR-100/52)

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RADIOLOGICAL SAFETY REGULATIONS (Revised 1951). [nd] 57p. (NP-4064; U23300; NavMed P-1325)

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NUCLEAR TWO-BODY INTERACTIONS, by J. David Jackson. July 25, 1950. 53p. (NRC-2395; LT-28)

NRC-2610 5858
Atomic Energy Project (Canada)
THE PRINCIPLE OF DETAILED BALANCING IN ATOMIC AND NUCLEAR PHYSICS, by J. D. Jackson. Aug. 1951. 34p. (NRC-2610; LT-32)

NRC-2611 5790
Atomic Energy Project (Canada)
RECENT DEVELOPMENTS IN BETA-DECAY THEORY AND THE INTERACTION BETWEEN PARTICLES OF SPIN ONE-HALF, by M. A. Preston. Aug. 29, 1951. 29p. (NRC-2611)

ONRL-76-52 5741
Office of Naval Research, London (England)
RADIOACTIVATION METHOD FOR THE DETERMINATION OF MICRO-QUANTITIES OF URANIUM, by S. Fred Singer. Aug. 1, 1952. 12p. (ONRL-76-52)

TEI-170 5776
Geological Survey
VOLCANIC DEBRIS IN URANIFEROUS SANDSTONES, AND ITS POSSIBLE BEARING ON THE ORIGIN AND PRECIPITATION OF URANIUM, by Aaron C. Waters and Harry C. Granger. Aug. 1952. 63p. (TEI-170)

TEI-237 5777
Geological Survey
ORIGIN OF THE CHATTANOOGA SHALE, by L. C. Conant. July 1952. 22p. (TEI-237)

TEI-243 5778
Geological Survey
SECOND OCCURRENCE OF BAYLEYITE IN THE UNITED STATES, by T. W. Stern and Alice Dowse Weeks. July 1952. 5p. (TEI-243)

TEM-429 5779
Geological Survey
LOS GIGANTES SE, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA, by J. D. Strobell, Jr. Aug. 1952. 2p., 1 illus. (TEM-429)

NUCLEAR SCIENCE ABSTRACTS

Vol. 6 October 31, 1952 No. 20

GENERAL

ATOMIC POWER

5711

Knolls Atomic Power Lab.

A STUDY OF ELECTRIC POWER GENERATION UTILIZING HEAT ENERGY FROM POWER BREEDER REACTORS, by R. H. Shannon, J. D. Selby, and M. B. Dagan. Nov. 19, 1951. Decl. Aug. 27, 1952. 45p. (AECD-3444; KAPL-591)

The reactor heat capacities, steam conditions, installed electric-power-generating capacity, estimated plant investment capital, and estimated energy cost are tabulated for six types of reactors (500, 1000, and 2000 Mw using either liquid Na or high-pressure water). The following conclusions and recommendations are made. The cost of electric power generation utilizing heat energy from power breeder reactors is economically comparable to the cost of generation of electric power by oil-fired-steam-power plants, provided the capital investment and operating costs of the reactor and basic reactor cooling systems are not charged to the cost of electric power generation. Electric power generation utilizing heat energy from liquid-Na-cooled reactors is substantially more attractive economically than utilizing heat energy from high-pressure water-cooled reactors. In order to be able to deliver reliable electric power it is recommended that the plant heat sources be divided among two or more reactors, (or that stand-by conventional steam boilers be provided to allow for reactor refueling and outage time). It is recommended that the heat energy available from one reactor in a plant not exceed 500 Mw. Based on present power consumption the operating electric power systems, with some exceptions, could not easily utilize the power generated by a plant having reactors rated in excess of 500 Mw.

5712

BASIC PROBLEMS IN CENTRAL-STATION NUCLEAR POWER. W. H. Zinn. Nucleonics 10, No. 9, 8-14(1952) Sept.

Economic considerations in the production of electric power from nuclear reactors are discussed. Some operating characteristics of the Experimental Breeder Reactor at Arco, Idaho, are mentioned.

RESEARCH PROGRAMS

5713

Brookhaven National Lab.

QUARTERLY PROGRESS REPORT FOR APRIL 1 - JUNE 30, 1952; UNCLASSIFIED SECTION. [nd] 42p. (BNL-189)

Abstracts of published reports and talks form the nucleus of this report by the departments of physics, instrumentation and health physics, acceleration, chemistry, reactor science and engineering, biology, and medicine. Also included are brief statements of work in progress and preliminary results, plus a more lengthy discussion of full-energy operation of the Cosmotron.

BIOLOGY AND MEDICINE

5714

Argonne National Lab.

CINEMATOGRAPHY OF BINUCLEATE CELL FORMATION IN MELANOPLUS DIFFERENTIALIS SPERMATOCYTES, by T. N. Tahmisian and A. M. Brues. July 1952. 1p. (AECU-2202; UAC-597)

The spermatocyte cysts of the grasshopper testis contain many nuclei, each without a definite cell membrane. The formation of a binucleate cell has been recorded in the course of a time-lapse cinematographic study of cell division in which Leitz phase-contrast equipment was used. Spermatocytes in a dextrose-Belar solution in bicarbonate buffer, pH 7.0, were placed on a roto-compressor slide. One of the cells began to divide from a prophase stage, and the metaphase and anaphase stages passed in normal fashion. When early telephase was reached, there was a narrow tubular bridge between the two newly-forming daughter cells. The nucleus in each daughter cell developed a nuclear membrane. During the ensuing 6 hr the contracting cell membrane displaced part of the cytoplasm from one daughter cell to the other. In this phase the nuclei remained undisturbed. Finally, at the tubular bridge, between the two daughter cells, a piece of protoplasmic material resembling mitochondria was extruded from the cytoplasm. After this extrusion the narrow bridge began to expand and the daughter cells came together, forming the binucleate cell. In 1942 Beams and King (Anat. Record 83, 281-97(1942)) formulated a theory for such binucleate cell formation while they were studying fixed tissue from regenerating rat liver. This work confirms their theory. There may be other types of binucleate cell formation. This is one kind, however, that has been observed and recorded. (Entire report.)

RADIATION EFFECTS

5715

Chicago Univ.

OBSERVATIONS ON THE PATHOGENESIS OF POST-IRRADIATION BACTEREMIA, by Lee E. Gordon and C. Phillip Miller. [nd] 6p. (AECU-2194)

In an investigation of the mechanism by which intestinal bacteria gain entrance into the blood stream in irradiated mice and of the explanation for the long interval between irradiation and the onset of bacteremia, mice were fed Serratia marcescens in their drinking water for 2 days before irradiation and until sacrificed. From results of the study, it was concluded that in the x-rayed mouse bacteria find their way out of the intestine and are localized in the mesenteric lymph modes just as in the normal animal. Those escaping are removed by normal defense mechanisms which prove adequate for a time. As the post-irradiation period lengthens, the defense mechanisms become ineffective and a bacteremia ensues.

5716

Radiological Research Lab., Columbia Univ.

ANNUAL REPORT ON RESEARCH PROJECT. by G. Failla and H. H. Rossi. June 1, 1952. 128p. (NYO-4008)

Physics: Tissue equivalent ionization chambers for the measurement of slow neutrons have been constructed entirely of non-metallic materials and have shown negligible induced activity following exposure to slow neutrons. In the course of experiments to determine if a difference in stopping power between water and water vapor exists, it has been found that there is no significant difference in stopping power between acetylene and polystyrene. A value of 32.5 ev was obtained for the average energy (W) lost by an electron per ion pair

produced in air for the β spectrum of S^{35}. A difference of practical importance was found between values of relative stopping power of water and air determined experimentally and those predicted by the Bethe-Bloch theory for β rays of P^{32} and S^{35}. Depth and surface dose measurements made with $Sr^{90} + Y^{90}$ and RaD + E applicators are presented. A machine for the preparation of 6 × 6-in. plane standards of known and uniform concentrations of radioactive materials has been constructed and is described. Biology: Cytological and histological observations on various hamster tissues after exposure of the animals to 2-Mv x rays under the conditions of "death under the beam" and "delayed death" are presented. In mice subjected to a lethal dose of whole-body radiation a slightly higher water content was shown as a whole but a marked difference was found in the adrenal gland and the intestine. Results of in vitro respiration studies indicated that the kidneys of x-rayed mice show no change in oxygen consumption 3 hours after irradiation but a slight decrease 4 days after the irradiation; no significant change was found with leukocytes. That x irradiation increases the absorption rate of subcutaneously injected solutions was also determined and the possible consequences of this are discussed. The radiation-induced cataract work has confirmed the protective effect of pre-treatment with cysteine on the lens; other sulfhydryl-containing compounds were found to be less effective than cysteine, as were some other chemical reducing agents. The observations that cysteine treatment prolongs the inhibitory effect of x rays on mitosis in the eye is also reported.

5717

Oak Ridge National Lab.

MAMMALIAN RADIATION GENETICS, by W. L. Russell. Issued Aug. 11, 1952. 16p. (ORNL-1337)

The general features of the genetic hazards of radiation are reviewed. Experimental studies on gene mutations and chromosome aberrations are compared with data obtained on Drosophila and mice. Published calculations of the genetic hazards of radiation in man are evaluated.

5718

RELEASE OF HEPARIN IN ANAPHYLACTIC SHOCK IN IRRADIATED AND NON-IRRADIATED ANIMALS. Frank C. Monkhouse, Edward Fidlar, and John C. D. Barlow. Am. J. Physiol. 169, 712-20(1952) June.

A study has been made of the release of heparin in anaphylactic shock in irradiated and nonirradiated animals. The heparin was obtained from the blood by a direct chemical method and could be detected in amounts greater than 0.01 mg per cent. In irradiated rats, no heparin could be found in the blood and anaphylaxis could not be produced in this species for further testing. In irradiated guinea pigs, no heparin was found in the blood before shock. After shock, heparin appeared in the blood, although there was no significant change in clotting time. The irradiation did not appear to influence the amount of heparin released in comparison with nonirradiated animals. In irradiated rabbits, no heparin was found in the blood before shock. After shock, heparin appeared in the blood, but there was only slight effect on clotting time. Irradiation tended to increase the heparin output in response to a given amount of antigen, provided this amount caused a submaximal response in the nonirradiated animal. In dogs given slow but fatal irradiation, no heparin was found in the blood before shock. Heparin was released readily during shock and had a pronounced effect on clotting time. Irradiation tended to increase the heparin produced by a given dose of antigen, provided this dose caused a submaximal response in sensitized nonirradiated dogs. (auth)

5719

DELAYED RADIATION EFFECTS AT HIROSHIMA AND NAGASAKI. John C. Bugher. Nucleonics 10, No. 9, 18-21 (1952) Sept.

Present facilities available to the Atomic Bomb Casualty Commission are described, and work in progress on frequency of leukemia, cataracts, and genetic changes is summarized. Sociological and psychological changes in the inhabitants of Hiroshima and Nagasaki are noted, and post-treaty relations of the Commission with the Japanese government and the Atomic Energy Commission are discussed.

5720

EVALUATION OF FOOD STERILIZATION EFFICIENCY. S. A. Goldblith and B. E. Proctor. Nucleonics 10, No. 9, 28-9(1952) Sept.

Efficiency and power requirements of cathode-ray sterilization of foods and drugs are discussed. It is shown that by obtaining simple data as to the size of the absorber, its density, and the specifications of the irradiation equipment, the throughput of a particle accelerator into a given product can be readily calculated and the optimum specifications for the cathode-ray equipment can be determined.

RADIATION HAZARDS AND PROTECTION

5721

Bureau of Medicine and Surgery, Dept. of the Navy

RADIOLOGICAL SAFETY REGULATIONS (Revised 1951). [nd] 57p. (NP-4064; U23300; NavMed P-1325)

Protective measures and safety regulations to be observed in all peacetime laboratory and industrial operations (naval) dealing with ionizing radiations or radioactive materials are described. Information is given on the types of radiological hazards; maximum permissible exposures; medical examinations; photographic dosimetry; personnel protection; use of radioactive isotopes; the organization and duties of the Radiological Defense Staff; storage and transportation of radioactive materials; waste disposal; and safety indoctrination. The federal rules and regulations on transportation of radioactive materials are appended.

RADIOTHERAPY

5722

THE RELATIVE BIOLOGIC EFFECTIVENESS OF 200 KV AND 23.5 MEV (BETATRON) X-RADIATION. I. PRODUCTION OF LEUKOPENIA IN MICE. T. P. Ting, H. E. Johns, and L. B. Jaques. Blood 7, 826-35(1952) Aug.

The leukocyte value in the peripheral blood of three different strains of mice was followed after a single dose of whole-body x radiation. The maximum leukocyte depression was used as a basis for comparing the biologic effectiveness of the betatron radiation and the 200-kv x radiation. The ratio of effectiveness in producing 70 per cent leukocyte reduction, for betatron radiation to 200-kv x radiation, for the three strains was 0.65. The onset of recovery from leukopenia for equal doses of radiation occurred earlier in animals treated with betatron radiation than in those treated with a similar dose of 200-kv x radiation. The degree of leukopenia and delay in recovery was found to increase somewhat with age of animals treated with 200-kv x radiation and to a less extent in animals treated with betatron radiation. At a dose of 600 r, over 90 per cent of the animals treated with 200-kv died within a few days, while none of the animals exposed to the same dose of betatron radiation died in the same period. The leukocyte count immediately before death was about 2 per cent of control values. For a dose of 600 r, the lymphocytes were equally reduced by 200-kv and betatron radiation, while the granulocytes were much less reduced by betatron than by 200-kv radiation. (auth)

5723

UPTAKE OF RADIOACTIVE SULFUR BY CHONDROSARCOMAS IN MAN. Raymond G. Gottschalk and Herbert C. Allan, Jr. Proc. Soc. Exptl. Biol. Med. 80, 334-9(1952) June.

Two patients with chondrosarcomas received, respectively, 6.7 and 2.9 millicuries of S^{35} as sodium sulfate. Tissue samples were obtained at operations and at necropsy several days after the injection and were analyzed for S^{35} content. The highest concentrations of isotope were found in the chondrosarcomas. Progressively smaller amounts were found in other tissues in the sequence: cartilage, bone marrow, spleen, kidney, skin, liver, bone, adipose tissue, and muscle. Radioautographs indicated maximum concentration in the growing portions of the chondrosarcoma and in those containing abundant ground substance. The findings are discussed in relation to the possibility of diagnostic or therapeutic applications. (auth)

TOXICOLOGY STUDIES

5724
Naval Medical Research Inst., Bethesda
STUDIES OF THE METABOLISM OF GERMANIUM, by George Rosenfeld. Apr. 16, 1952. 16p. (NP-4044)

Metabolic studies have been conducted of the absorption, transport, distribution, storage, and excretion of inorganic Ge (GeO_2) in albino rats. The analytical data demonstrate that Ge is rapidly absorbed after oral, subcutaneous, intramuscular, or intraperitoneal administration. When injected directly into the systemic circulation or absorbed following oral or parenteral administration, it is transported unbound by plasma proteins and is rapidly eliminated from the blood stream. Ge is not deposited selectively but is widely distributed among all the organs. It is not retained or stored by any tissue even after many weekly doses, but is rapidly excreted via the urine and feces, the kidney being the main excretory organ. A survey of the tissues of untreated rats did not indicate the normal occurrence of Ge as a microconstituent. Ge appears relatively inert metabolically (auth)

5725
Naval Medical Research Inst., Bethesda
PHARMACOLOGICAL STUDIES OF RADIOGERMANIUM (Ge^{71}), by H. C. Dudley, E. J. Wallace, and L. J. Louviere. May 29, 1952. 15p. (NP-4048)

A method for the determination of radioactive Ge (Ge^{71}) in biological materials has been developed and applied in the study of the pharmacological behavior of GeO_2 and some insoluble particulate Ge preparations. Results indicate that intraperitoneal injections of suspensions of GeO_2, GeS_2, and finely divided Ge are readily dissolved by the dog and rabbit. Excretion is rapid by way of the kidneys. At the end of 72 hr only trace amounts remain in any tissue. No significant tissue localization occurs. GeO_2 appears to be pharmacologically inactive. Because of the low energy (9-kv γ) of Ge^{71}, the biological effectiveness of this isotope is not significant. (auth)

TRACER APPLICATIONS

5726
RADIOISOTOPES IN SOILS RESEARCH AND PLANT NUTRITION. S. B. Hendricks and L. A. Dean. Ann. Rev. Nuclear Sci. 1, 597-610(1952).

Application of various radioisotopes to soils research and plant nutrition is reviewed. Field and greenhouse experiments with P^{32} are reviewed. 71 references.

5727
STABLE ISOTOPES IN BIOCHEMICAL RESEARCH. D. Rittenberg and T. D. Price. Ann. Rev. Nuclear Sci. 1, 569-96(1952).

The review of stable isotopes in biochemical research includes the following: natural abundances, paleotemperatures, amino acids, trans reactions, rate of protein synthesis, nucleic acids, purines, pyrimidines, drugs, lipids, porphyrin metabolism, measurement of total body water in man, fixation of C and N_2, and miscellaneous investigations. 177 references.

5728
RADIOISOTOPES IN BIOCHEMICAL AND MEDICAL RESEARCH. Claude A. Villee. Ann. Rev. Nuclear Sci. 1, 525-68(1952).

Application of radioisotopes to biochemical and medical research is reviewed. Reviews of research include the following: new methods in isotope research; the citric acid cycle; CO_2 fixation; photosynthesis; metabolism of carbohydrates, proteins, porphyrin, "one-carbon fragments," choline, fatty acids, phospholipids, steroids, nucleic acids, purine and pyrimidine, viruses, K, S, I, and minerals, the determination of intra- and extracellular volume, studies on permeability, the synthesis and application of isotopically labeled drugs, and the use of isotopes in immunology. 348 references.

CHEMISTRY

5729
Illinois Univ.
INTRAMOLECULAR CARBON ISOTOPE EFFECTS IN THE DECARBOXYLATION OF MALONIC ACID AND BROMOMALONIC ACID, by Peter E. Yankwich and Edward C. Stivers. [nd] 19p. (AECU-2146(Rev.))

The intramolecular isotope effects in the decarboxylation of C^{13} and C^{14} carboxyl-labeled malonic and bromomalonic acids have been determined. The observed C^{13} effects are in agreement with the results of other investigators; the C^{14} effects are in partial agreement with earlier published results of one of the authors. The ratio of C^{14} to C^{13} effects is found to be near 3.6. (auth)

5730
Atomic Energy Research Establishment, Harwell, Berks (England)
CALCULATION OF THE ACTIVITY COEFFICIENTS OF MIXED AQUEOUS ELECTROLYTES FROM VAPOUR PRESSURES, by E. Glueckauf, H. A. C. McKay, and J. K. Perring. Apr. 24, 1952. 11p. (AERE C/R-898)

Improved thermodynamic equations have been derived for the calculation of the activity coefficients of solutes present in mixed solution from the vapor pressures of such solutions. The case of two 1:1 electrolytes in water has been considered especially. The new equations are very suitable for application to sets of isopiestic experiments. The equations have been applied to data for LiCl and KCl in aqueous solution, and the coefficients α_{12} and α_{21} of Harned's equations $\log \gamma_1 = \log \gamma_1^0 - \alpha_{12} m_2$ and $\log \gamma_2 = \log \gamma_2^0 - \alpha_{21} m_1$ have been calculated. The results show clearly that even in this comparatively ideal case, the α's are linear functions not only of the total ionic strength $m = m_1 + m_2$, but also of the fractions $x_1 = m_1/m$ or $x_2 = m_2/m$, whereas according to Harned's rule the α's may vary with m, but not with the x_1 or x_2. In spite of this behavior the simple relation $\gamma_1^t \simeq \gamma_2^t$ holds, where γ_1^t is the activity coefficient of a trace of LiCl in a KCl solution, and γ_2^t of a trace of KCl in LiCl. (auth)

5731
Carbide and Carbon Chemicals Co. (K-25)
APPARATUS FOR RAPID DETERMINATION OF LIQUID-LIQUID AND LIQUID-SOLID EQUILIBRIA, by W. Davis, Jr., L. L. Conley, and G. P. Rutledge. Issued Aug. 12, 1952. 6p. (K-934)

An apparatus has been built for measurement of temperatures at which phase changes (precipitation of solid or liquid from a homogeneous solution) are visually observed to occur. This apparatus was constructed for use with

corrosive chemicals, such as anhydrous hydrogen fluoride, which are contained in a fluorothene tube. The tube has appropriate thermal shielding and is shaken vigorously to allow relatively large rates of heating or cooling. Precisions of temperature measurement in the order ±0.5°C are attainable. (auth)

5732
Pennsylvania State Coll.
WETTING OF SOLIDS AS INFLUENCED BY THE POLARIZABILITY OF SURFACE IONS, by W. A. Weyl. Sept. 30, 1952. 100p. (NP-4051)

The influence of the polarization of ions on the atomic structure of surfaces of ionic substances is described, and a qualitative picture of the forces emanating from surfaces is derived. The application of the author's concept of surface structure to the interactions of some solids with water is shown.

5733
THE CHROMIC ACID OXIDATION OF ISOPROPYL ALCOHOL IN 86.5% ACETIC ACID SOLUTION; THE CHEMISTRY OF THE CHLOROCHROMATE ION. Merrill Cohen and F. H. Westheimer. J. Am. Chem. Soc. 74, 4387-91(1952) Sept. 5.

The chromic acid oxidation of isopropyl alcohol in 86.5% acetic acid is first order in the alcohol, in acid chromate ion and in hydrogen ion, but proceeds 2500 times as fast as in water. The relative rates of oxidation of $CH_3CDOHCH_3$ and of $CD_3CHOHCD_3$, compared to that of $CH_3CHOHCH_3$ are the same as in water. The mechanism for the oxidation is therefore probably the same as in aqueous solution. The oxidation is strongly inhibited by chloride ion, and in the presence of chloride ion the ultraviolet absorption spectrum of chromic acid in acetic acid is modified. Both the spectroscopic data and the kinetic data for the reaction in the presence of chloride ion can be correlated with an equilibrium constant of 1×10^{-5} (mole/liter)$^{-2}$ for the reaction $H^+ + Cl^- + HCrO_4^- \rightleftharpoons ClCrO_3^- + H_2O$ together with the assumption that the chlorochromate ion is a poor oxidizing agent (as compared with the acid chromate ion) for isopropyl alcohol. (auth)

ANALYTICAL PROCEDURES

5734
Argonne National Lab.
THE DETERMINATION OF PHOTOGRAPHIC FILM EXPOSURE BY NEUTRON ACTIVATION OF Ag, by I. B. Berlman, H. F. Lucas, and H. A. May. July 1952. 4p. (AECU-2197; UAC-601)

A procedure for the determination of photographic film exposure by neutron activation of the Ag in the film is described, and comparison is made with optical densitometric measurements. Densitometer and neutron-activation measurements were found to agree at low exposures. The densitometer readings were found to be less accurate at higher film densities, whereas the activation method was found to become more accurate with higher exposure and with use of stronger neutron sources.

5735
Oak Ridge National Lab.
THE VOLUMETRIC DETERMINATIONS OF URANIUM(VI) IN PHOSPHATE SOLUTIONS, by J. M. Schreyer and C. F. Baes, Jr. [nd], Decl. Aug. 27, 1952. 9p. (AECD-3438; ORNL-1292)

The Dichromate method of Kolthoff and Lingane (J. Am. Chem. Soc. 55, 1871(1933)) for the determination of U has been applied to phosphate solutions. The recommended procedure involves the use of 4.5M sulfuric acid solution in the Jones reductor to avoid U(IV) phosphate precipitation. The reduction of U(VI) to U(IV) in phosphate solution is shown to be quantitative, thus eliminating the need for aeration of the reduced solution. (auth)

5736
Atomic Energy Research Establishment, Harwell, Berks (England)
THE DETERMINATION OF OXYGEN IN URANIUM OXIDES, by L. E. J. Roberts and E. A. Harper. May 5, 1952. 7p. (AERE C/R-885)

The oxygen in excess of the composition $UO_{2.000}$ in a higher uranium oxide can be measured by reducing to $UO_{2.000}$ with hydrogen or carbon monoxide and measuring the water or carbon dioxide formed. The accuracy of the method described is ±3% on the excess oxygen. Possible ways of improving the accuracy and the limitations of the accuracy of the method due to chemisorption of hydrogen are discussed. (auth)

5737
Atomic Energy Research Establishment, Harwell, Berks (England)
THE DETERMINATION OF SMALL QUANTITIES OF URANIUM IN ROCKS AND MINERALS BY RADIOACTIVATION, by A. A. Smales. May 13, 1952. 18p. (AERE C/R-930)

The determination of microgram amounts of uranium in minerals and rocks by neutron irradiation followed by radiochemical separation and measurement of fission product barium is described. The method has been applied to a number of different types of mineral containing as little as 0.0003% uranium using sample weights of less than 0.5 g. Results show good agreement with those obtained on larger samples by accepted methods of analysis. The method may be of value where the available sample is small, e.g., in some cases of geological age determination on individual minerals separated from parent rocks. The advantages of the new method over existing techniques are outlined. (auth)

5738
Ames Lab.
SPECTROPHOTOMETRIC DETERMINATION OF THORIUM IN MONAZITE SANDS, by Charles V. Banks and Carol H. Byrd. Sept. 1, 1952. 24p. (ISC-263; LR-105)

The better methods for the analysis of monazite sands are reviewed. A rapid and accurate spectrophotometric method for the determination of Th in monazite sands is outlined. The method consists of the decomposition of the sand by a potassium bifluoride fusion, the insoluble fluorides containing all of the rare earths and Th are digested in dilute HF, and finally separated by centrifugal action. These fluorides are dissolved in a saturated $Al(NO_3)_3$ solution acidified with HNO_3. The Th is separated from this latter solution by extraction into mesityl oxide and is then stripped from the solvent with water. Appropriate aliquots of this aqueous solution are reacted with the reagent "Thoron" to produce the colored complex ion which is the basis for the spectrophotometric determination.

5739
Naval Medical Research Inst., Bethesda
A COLORIMETRIC METHOD FOR THE DETERMINATION OF GERMANIUM IN BIOLOGICAL MATERIALS, by George Rosenfeld. Apr. 16, 1952. 16p. (NP-4042)

A colorimetric method has been developed for the determination of Ge in biological materials. The Ge is distilled as $GeCl_4$ from a sample digested with nitric and sulfuric acids. Upon the addition of ammonium molybdate and ferrous ammonium sulfate to the buffered distillate, a blue color is formed, the intensity of which is a linear function of the concentration from 2 to 50 μg. Amounts up to 500 μg can be determined with the use of a proper diluent. Large quantities of silicates, arsenates, or phosphates do not interfere with the procedure. Preliminary metabolic studies revealed the retention of only small amounts of Ge and no selective deposition in any particular organ of the rat 24 hr after the intraperitoneal injection of neutralized GeO_2 (pH 7.3). (auth)

5740
Tour, Sam, and Co., Inc.
FINAL TECHNICAL REPORT [ON] RESEARCH AND DEVELOPMENT OF METHODS OF CHEMICAL ANALYSIS FOR TITANIUM METAL AND ITS ALLOYS AS PART "A" OF CHEMICAL ANALYSIS AND VAPOR DEPOSITED COATINGS FOR TITANIUM, by Dennis Ord. June 13, 1952. 51p. (NP-4052; WAL Report No. 401/48/A-12)

In the 8-hydroxyquinoline gravimetric method for Al in Ti metal and alloys following a cupferron separation, Fe, Cr, and Mo indicate possible interference. Mn provides serious interferences. The analysis of W in Ti alloys may be carried out using a-benzoinoxime as the precipitating agent, provided that the sample taken is small enough so that the amount of W present is less than 10 milligrams. Versene is of no value in separating W and Ti or in separating Nb and Ta from Ti. The analysis of Nb and Ta by weighing as the oxides following a tannin separation has not proved entirely accurate nor satisfactory.

5741
Office of Naval Research, London (England)
RADIOACTIVATION METHOD FOR THE DETERMINATION OF MICRO-QUANTITIES OF URANIUM, by S. Fred Singer. Aug. 1, 1952. 12p. (ONRL-76-52)

A method is presented for the determination of microgram amounts of U in minerals and rocks. The method consists of neutron irradiation followed by chemical separation and activity measurement of fission-product Ba. The method has been applied to a number of different types of minerals containing as little as 0.0003% U using sample weights of less than 0.3 g. The ultimate sensitivity of the method is estimated to be $\sim 10^{-8}$ g of U. The ultimate object of the investigation was an attempt to provide methods of age determination of individual minerals isolated from small quantities of rocks.

5742
ANALYTICAL NUCLEAR CHEMISTRY. C. J. Rodden. Ann. Rev. Nuclear Sci. 1, 343-62(1952).

The work done in the field of nuclear chemistry from 1948 to 1950 is reviewed. General nuclear chemistry, chemical determinations, activation and absorption, and theoretical analytical chemistry are reviewed. 193 references.

5743
DETECTION AND COLORIMETRIC ESTIMATION OF VANADIUM WITH BENZOHYDROXAMIC ACID. A. K. Das Gupta, and M. M. Singh. J. Sci. Ind. Research (India) B11, 268-73 (1952) July.

The conditions for the detection and estimation of microgram amounts of V in the presence of large excess of foreign ions by the characteristic colors of the complexes formed by V with the K salt of benzohydroxamic acid have been presented. The limiting sensitivity of the blue complex formed in concentrated HCl solutions is 0.005 microgram in a concentration of 1 : 2,000,000. The estimation of microgram quantities of V in presence of large excess of such ions as Na, Mg, Ca, Sr, Ba, Zn, Al, Ti, Pb, Th, As, Mo, W, Fe, phosphate, silicate, and acetate is best carried out in a 50% alcoholic medium slightly acidified, and containing 0.025 g/cc ammonium fluoride; copper and chromate under the same conditions are tolerated to a limited extent. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5744
Radiation Lab., Univ. of Calif., Berkeley
THE CRYSTAL STRUCTURES OF NpC AND Pu_2O_3, by D. H. Templeton and Carol H. Dauben. July 14, 1952. Decl. Aug. 27, 1952. 6p. (AECD-3443; UCRL-1886)

NpC and Pu_2O_3 have been identified by x-ray diffraction. NpC is face-centered cubic, NaCl structure with $\underline{a}$ = 5.004 ± 0.005 A. Pu_2O_3 is isomorphous with the hexagonal "A form" for the rare-earth sesquioxides with $\underline{a}$ = 3.840 ± 0.004 A and $\underline{c}$ = 5.957 ± 0.006 A and has essentially the same atomic parameters as La_2O_3. The lattice dimensions are smaller than predicted for pure Pu_2O_3, implying that the average oxidation number of Pu is between III and IV. (auth)

5745
Radiation Lab., Univ. of Calif., Berkeley
CRYSTAL STRUCTURES OF SODIUM SUPEROXIDE AND YTTRIUM TRICHLORIDE (thesis), by G. F. Carter. Aug. 1952. 71p. (UCRL-1908)

Crystal structures of two low-temperature forms of NaO_2 have been deduced from Debye-Scherrer powder-diffraction patterns and Weissenberg equi-inclination photographs. Apparatus for taking x-ray-diffraction patterns at low temperatures over a range from room temperature to 100°K was constructed. Two rapid, reversible transitions were found to occur at −50 and −77°C; NaO_2-II, stable between −50 and −77°C, has a pyrite-type structure with space group T_h^6 − Pa3 and lattice constant a = 5.48 A. After single crystals had been grown from a solution of NaO_2 in liquid NH_3, the structure of NaO_2-III was found to be orthorhombic (space group D_{2h}^{12} − Pnnm) with lattice constants a = 4.26 A, b = 5.54 A, c = 3.44 A. Parameters of O atoms were chosen primarily on the basis of geometrical arguments for most economical packing, and these agreed with parameters found upon calculation of an electron density section using data from the powder pattern. A close comparison exists between the structures of NaO_2-II and pyrite and likewise between NaO_2-III and marcasite (also FeS_2). The crystal structure of YCl_3, deduced from single-crystal, equi-inclination Weissenberg photographs, indicates a monoclinic unit cell: β = 110°20′, a = 6.92 A, b = 11.94 A, c = 6.44 A; the structure, having the space group C_{2h}^3 − C2/m, consists roughly of six layers of atoms stacked in planes perpendicular to the b axis. The arrangement of Cl atoms is such that they approximate a face-centered cubic, closest packing of spheres. Each yttrium atom has three closest Y neighbors at a distance of 4.0 A and six nearest Cl neighbors at 2.65 A; Cl atoms each have 12 Cl neighbors at distances varying between 3.54 and 4.38 A. Dy, Ho, Er, Tm, Yb, and Lu trichlorides are isostructural with YCl_3, and lattice parameters for those compounds were obtained from x-ray-diffraction powder patterns. (auth)

FLUORINE AND FLUORINE COMPOUNDS

5746
Jet Propulsion Lab., Calif. Inst. of Tech.
THE HEAT OF DISSOCIATION OF FLUORINE, by Russell N. Doescher. Nov. 2, 1951. 10p. (NP-4003; Report No. 20-61; ATI-133893)

Equilibrium-pressure measurements of the dissociation of F_2 were reported with the use of a Ni vessel coated stepwise by heating in contact with F at temperatures up to 850°C and a differentially applied manometer containing a fluorinated oil. This latter technique made it possible to carry out the measurements in the comparatively low temperature range 759° to 1115°K. The method consisted essentially of a direct comparison of the pressure variation with temperature of a quantity of F with that of a quantity of N. Twenty-four determinations of the equilibrium constant were made, and in a plot of ln K as a function of 1/T the points gave a straight line. The slope gave ΔH = 37.7 kcal/mole as the mean heat of dissociation in the temperature range of the experiments for the reaction $F_2(g) \rightarrow 2F(g)$. This ΔH value is in good agreement with values calculated from entropy quantities and values of ln K obtained from the line. Description of apparatus and the experimental procedures are given. (cf. NSA 5-6143)

5747
Minnesota Mining and Manufacturing Co.
QUARTERLY PROGRESS REPORT NO. 10 [FOR] AUGUST 1951 TO OCTOBER 1951, by W. H. Pearlson. [nd] 71p.

(NP-4039; Quarterly Progress Report No. 10)

Oil-resistant fluorinated elastomers for use at low temperatures were prepared and evaluated. Polymerization of perfluorobutadiene, perfluoroacrylonitrile, and vinyl β-hydroperfluoroalkyl ethers is studied. Poly-1,1-dihydroperfluorohexyl acrylate copolymers appear to be superior to poly-1,1-dihydroperfluorobutyl acrylate with regard to the balance between solvent resistance and low-temperature flexibility. The polymerization of 1,1-dihydroperfluorobutyl acrylate system was studied, and the inclusion of nitrile monomers as a third component gave increased fuel resistance and superior physical properties over the simple copolymer. The compound 1,1-dihydroperfluoroalkoxyethyl acrylate has given a homopolymer with properties comparable to the 1,1-dihydroperfluoroalkyl acrylate-butadiene copolymers. Vulcanization studies of fluorinated acrylate rubbers are reported. Preliminary evaluation of reinforcing agents shows that the conventional carbon blacks and inorganic pigments are of little value in the case of the acrylate homopolymer.

5748

PYROLYSIS OF FLUOROCARBONS. Robert K. Steunenberg and George H. Cady. J. Am. Chem. Soc. 74, 4165-8(1952) Aug. 20.

The pyrolytic decomposition of several gaseous fluorocarbons held in contact with a heated Pt filament has been studied at various temperatures and pressures. Apparently the filament acts as a catalyst. Under the conditions used the rate of decomposition increases in the order: C_2F_6, cyclo-C_5F_{10}, C_3F_8, n-C_4F_{10}, n-C_5F_{12}. The observed decomposition of octafluoropropane is a first-order reaction having an experimental activation energy of about 84 kcal/mole. In the case of hexafluoroethane the experimental evidence does not lead to a clear interpretation; however, it strongly suggests that the reaction is first order with an activation energy close to 51 kcal/mole. Pyrolysis of each of the compounds listed above gives rise to a gaseous product, a high polymer and a trace of carbon. Two unsaturated fluorocarbons, hexafluoropropene and octafluoro-2-methylpropene, found in the products have a high degree of thermal stability. While the experiments do not establish reaction mechanisms, they do indicate that the primary rupture in the molecule occurs at a carbon-carbon bond and that resulting unsaturated molecules or free radicals combine to form polymers. (auth)

5749

THIOLESTERS OF PERFLUOROCARBOXYLIC ACIDS. Murray Hauptschein, Charles S. Stokes, and Edward A. Nodiff. J. Am. Chem. Soc. 74, 4005-10(1952) Aug. 20.

A series of thiolesters and dithiolesters of perfluorofatty acids has been prepared by the reaction of perfluorofatty acid chlorides and anhydrides with thiols and dithiols. Perfluoroglutaric anhydride has been prepared and converted to its dithiolester by a three-step synthesis and to a polythiolester by a condensation-polymerization reaction. Infrared absorption and molecular refractivity data of fluorinated thiolesters and oxygen esters are compared with their nonfluorinated analogs, and various correlations are noted and interpreted. New light is shed on the influence of perfluoroalkyl groups on adjacent carbonyl groups. Certain "characteristic" wave length bands for fluorocarbon derivatives have been empirically assigned. (auth)

LABORATORIES AND EQUIPMENT

5750

Brookhaven National Lab.

HOT LABORATORY TECHNICAL REPORT. V. SMALL CORROSION-RESISTANT VALVES FOR REMOTE CHEMICAL SERVICE, by Gerald J. Selvin. May 1, 1952. 8p. (BNL-186)

Two small corrosion-resistant valves are described for remote radiochemical service. Both fill long-standing needs in this field and were developed to supplement existing commercially available units. (auth)

5751

Building Research Advisory Board, National Research Council and National Academy of Sciences

LABORATORY DESIGN FOR HANDLING RADIOACTIVE MATERIALS. RESEARCH CORRELATION CONFERENCE, NOVEMBER 27 AND 28, 1951. May, 1952. 140p. (NP-3875; Research Conference Report No. 3)

A conference on the design of a laboratory for handling radioactive materials, covering the air supply and exhaust system, control and shielding of isotopes, finishing of surfaces, and radioactive waste disposal, is reported in detail.

RADIATION CHEMISTRY

5752

THE EFFECT OF THE ISOMERIC TRANSITION IN Br^{80} ON ITS REACTIVITY WITH THE TETRACHLORIDES OF CARBON, SILICON, GERMANIUM, AND TIN. C. C. Coffin and W. D. Jamieson. J. Chem. Phys. 20, 1324-5(1952) Aug.

No obvious relation was observed between the equilibrium amount of Br^{80} activity acquired by liquid C, Si, Ge, or Sn tetrachlorides at room temperature and any one of their properties likely to be chemically significant. The reaction efficiencies are compared with bond strength, ionic character, and liquid densities.

5753

STUDIES IN LOW CONCENTRATION CHEMISTRY. I. THE RADIOCOLLOIDAL PROPERTIES OF LANTHANUM-140. Geo. K. Schweitzer and W. Morrison Jackson. J. Am. Chem. Soc. 74, 4178-80(1952) Aug. 20.

A separation of carrier-free La^{140} from Ba^{140} has been made, based on the radiocolloidal properties of La^{140} in basic solution. By use of separated La^{140} in solution, the effects of pH and Na nitrate concentration on radiocolloidal formation were investigated. The per cent of La that could be removed was found to increase, independent of coagulation time beyond 3.0 min, but dependent on Na nitrate concentration, to a maximum of almost 100% as the pH is increased. After the attainment of the maximum, changes in pH and/or salt concentration had little effect upon the per cent removal. Other electrolytes were added in varying amounts to La^{140} solutions of constant pH. Per cent removal decreased as the concentration of carbonate or citrate increased. Coagulation increased as the oxalate concentration increased up to 0.05N and then decreased above this concentration. (auth)

RADIATION EFFECTS

5754

Yale Univ.

EFFECT OF GAMMA RADIATION ON CHEMICAL REACTIONS. III. PRELIMINARY INVESTIGATIONS OF VAPOR-PHASE POLYMERIZATION OF ETHYLENE AT ROOM TEMPERATURE AND ATMOSPHERIC PRESSURE; PROGRESS REPORT NO. 3 (2nd Quarter, 1952). July 25, 1952. 14p. (NYO-3310)

A preliminary investigation of the gamma-initiated polymerization of ethylene at atmospheric pressure and room temperature has been made. In several runs, the rate of decrease of the total pressure of the gas samples being irradiated was measured, the residual gas was analyzed for hydrogen and saturated hydrocarbons, and the characteristics of the resulting polymer were observed. The observed rates of pressure decrease can be represented by first order rate constants of the order of magnitude of 0.01 per day. In contrast to the results of Lind on the α-particle-initiated reaction of ethylene and the electrical discharge reaction of ethylene, substantial amounts of hydrogen or saturated hy-

drocarbons were not found in the residual gas in the present investigation.

RARE EARTHS AND RARE-EARTH COMPOUNDS

5755

PURIFICATION OF YTTRIUM BY PRECIPITATION WITH SODIUM NITRITE. O. M. Hilal and M. El-Abbady. J. Chem. Soc., 2935-6(1952) July.

In studying the separation of Y from the rare earths by hydrolysis of the nitrite, it was found that the pH at initiation of nitrite precipitation increased with decreasing concentration of pure Y nitrate solutions. For 0.7M (80 g of Y_2O_3/liter) and 0.35M solutions the respective pH values were 6.2 and 6.4, of which the latter corresponds to pH 6.6 deduced from the curves of hydroxide precipitation of rare-earth nitrate solutions by very dilute gaseous NH_3. Addition of $NaNO_2$ to a solution of pH 6.2 does not alter its pH value, and so precipitation depends wholly on hydrolysis.

5756

THE USE OF NUCLEAR INDUCTION IN THE KINETIC STUDY OF THE REACTION $Eu^{+3} + \epsilon \rightarrow Eu^{+2}$. T. W. Hickmott and P. W. Selwood. J. Chem. Phys. 20, 1339 (1952) Aug.

The reduction of 0.0550 M aqueous $EuCl_3$ by Zn dust was studied in a nuclear-induction apparatus. A zero-order reaction was indicated for the first part of the reaction, with $k = 1.54 \times 10^{-4}$ moles/liter/sec. The initial rate-controlling steps are probably the desorption of Eu^{++} from the Zn surface and its diffusion through the solution. At a later stage when the reaction is no longer zero-order, the rate-controlling process is probably diffusion of reactant on to the Zn surface.

SEPARATION PROCEDURES

5757

Massachusetts Inst. of Tech.

THE EXTRACTION OF COBALT FROM NICKEL IN A PULSE COLUMN (thesis), by William L. Griffith, George R. Jasny, and Howard T. Tupper. 1952. Decl. Aug. 22, 1952. 95p. (AECD-3440; KT-114)

The effect of variation in the operating conditions of a pulse column (liquid-extraction contactor) upon the over-all height of a transfer unit has been studied. The chemical system used was $CoCl_2$–$NiCl_2$–ammonium thiocyanate–water–methyl isobutyl ketone. Heights of a transfer unit in the pulse column were as high as 34.2 in. and as low as 1.1 in., depending on the values of the pulse-column variables. Equilibrium data were obtained for the distribution of Co between an aqueous solution of $CoCl_2$ and ammonium thiocyanate and methyl isobutyl ketone. (auth)

5758

Ames Lab.

PERFORMANCE CHARACTERISTICS OF A PODBIELNIAK CENTRIFUGAL EXTRACTOR, by Norman Barson and G. H. Beyer. July 24, 1952. 38p. (ISC-262)

Liquid-liquid countercurrent extraction in a rotor spinning at 5000 rpm was studied. Inside the 18-in.-diam. rotor were 18 concentric perforated cylinders. Light liquid introduced at the periphery of the rotor was displaced inward by heavy liquid flowing outward from the axis. In passing through the perforations both phases formed new interfacial area at which extraction could take place. Density differences between the phases were accentuated by the centrifugal force field, speeding up separation of phases and permitting combined flow rates up to 7 gph with holdup times of only a few minutes. Using the system boric acid–isoamyl alcohol–water, runs were made extracting boric acid from alcohol into water, and from water into alcohol. Operation with clear effluent streams was possible over a range of light-liquid exit pressures, corresponding to varying amounts of light-liquid holdup in the rotor. Extraction results were expressed in terms of equilibrium stages, obtained by an analytical solution of the McCabe-Thiele method. The number of equilibrium stages increased with an increase in the ratio of the light-liquid flow rate to the heavy-liquid flow rate, and decreased with a decrease in the speed of rotation. The maximum number of stages, between 7 and 8, was realized when extracting from alcohol into water with a minimum holdup of alcohol in the water. (auth)

SORPTION PHENOMENA

5759

Texas Univ.

SORPTION OF GASES ON METAL POWDERS AND SUBSEQUENT CHANGE IN METAL REACTIVITY AT ROOM TEMPERATURE, by Hung Li Wang and Norman Hackerman. [nd] 19p. (NP-4046)

The amounts of Cl_2, NO_2, O_2, and CO taken up by powders of stainless steel, Ni, and Mo were measured at room temperature. Only CO was truly adsorbed on stainless steel and Ni powders forming a chemisorbing monolayer. All other gases appeared to have first adsorbed, then to have diffused inward, and finally to have reacted with the metals as suggested by the pressure dependence and irreversibility of the multilayer uptakes. Reactivities of metal powders in terms of H_2 evolution in dilute acid solutions in the absence of air were determined for reduced stainless steel, Ni, and Cr powders when bare, with CO adsorbed, or when covered with sorbed O_2. The chemisorbed CO or the sorbed O_2, both in limited quantity, altered only the induction period but did not change the ultimate rate of dissolution. Sorbed O_2 retarded the dissolution of stainless steel and Ni but had the opposite effect on Cr. Chemisorbed CO increased the induction period for stainless steel slightly, and that for Cr appreciably. For Ni, the chemisorbed CO retarded dissolution at first but later increased it.

SPECTROSCOPY

5760

Ames Lab.

THE INFRARED SPECTRA OF AROMATIC COMPOUNDS. I. EVIDENCE FOR INTRAMOLECULAR HYDROGEN BONDING BETWEEN SUBSTITUENT GROUPS AND RING HYDROGENS, by M. Margoshes and V. A. Fassel. Aug. 8, 1952. 20p. (ISC-259)

The infrared absorption spectra of some aromatic compounds have been studied between 625 and 900 cm^{-1}, where these compounds have C-H bending vibrations characteristic of the number and position of substituents. The band structure in this region was found, in many cases, to be considerably different from what is to be expected for the particular arrangement of substituents, particularly for nitro compounds, and carboxylic acids, esters, and salts. The deviations are explained by (1) a strong absorption band between 720 and 800 cm^{-1} for many of these compounds, and (2) a consistent shift of the normal C-H bending vibrations to higher frequencies, due to an intramolecular C-H—O bond. Intermolecular distances from X-ray diffraction data and the variations in position of the absorption band with variations in the structure of the compounds are given as evidence for the presence of the hydrogen bond. (auth)

SYNTHESES

5761

SYNTHESIS OF 2-METHYL-1,4-NAPHTHOQUINONE-4-C^{14}. Liang Li and William H. Elliott. J. Am. Chem. Soc. 74, 4089-90(1952) Aug. 20.

A new synthesis of the vitamin K substitute, 2-methyl-1, 4-naphthoquinone, has been developed and used to incorporate C^{14} into the 4-position of this compound. The reac-

tion sequence has been used successfully to prepare the quinone in an over-all yield of 25% based on the isotopic CO_2 using 5 mmoles of Ba carbonate-C^{14} of activities of 1 μc, 100 μc, and 2 mc. (auth)

5762

6-C^{14}-D-GLUCOSE AND 6-C^{14}-D-GLUCURONOLACTONE. John C. Sowden. J. Am. Chem. Soc. 74, 4377-9(1952) Sept. 5.

6-C^{14}-D-Glucose has been prepared from D-glucose through the following successive intermediates: 1,2-isopropylidene-D-glucofuranose, 5-aldo-1,2-isopropylidene-D-xylofuranose, 6-C^{14}-1,2-isopropylidene-D-glucofuranuronic acid and 6-C^{14}-1,2-isopropylidene-D-glucofuranurono-γ-lactone. The isotopic carbon was introduced through a cyanohydrin condensation between $NaC^{14}N$ and 5-aldo-1,2-isopropylidene-D-xylofuranose. The radiochemical yield of 6-C^{14}-D-glucose from $NaC^{14}N$ was approximately 10% while, as an alternative product, 6-C^{14}-D-glucuronolactone could be obtained in a radiochemical yield of approximately 18%. (auth)

TRACER APPLICATIONS

5763

ISOTOPIC TRACERS IN CHEMICAL SYSTEMS. R. R. Edwards. Ann. Rev. Nuclear Sci. 1, 301-42(1952).

Isotopic exchange reactions, effects of variable isotopic composition of molecules on tracer studies, application of tracers to the study of organic and inorganic reactions, and application of tracers to surface phenomena and diffusion are reviewed and discussed. 243 references.

TRANSURANIC ELEMENTS AND COMPOUNDS

5764

Los Alamos Scientific Lab.

EQUILIBRIA AND REACTION RATES IN THE DISPROPORTIONATION OF Pu(IV), by Sherman W. Rabideau. [nd] Decl. Aug. 26, 1952. 17p. (AECD-3433; LADC-1199)

The equilibrium quotients and the specific rate constants for the disproportionation of Pu(IV) have been measured as a function of hydrogen and plutonium ion concentrations in perchloric acid solutions of unit ionic strength at 25.00 ± 0.02°. Instead of obtaining the plutonium ion concentrations spectrophotometrically as has been done by previous workers, measurements of the mean oxidation number of the solutions were combined with electromotive force measurements of the Pu(III)–Pu(IV) couple and the total plutonium ion concentrations. From these data it is possible to calculate the concentrations of Pu(III), Pu(IV) and Pu(VI) present in the solutions at any time. The equilibrium quotient for the disproportionation reaction has been found to be directly dependent upon the fourth power of the hydrogen ion concentration, thus supporting the existence of the plutonyl ion, PuO_2^{++}, in these solutions. A weighted mean value of 0.0089 was found for the Pu(IV) disproportionation equilibrium quotient in perchloric acid solutions of unit ionic strength at 25°. The rate of the forward (disproportionation) reaction has been found to exhibit an inverse third power hydrogen ion concentration dependence and the most probable rate determining step of this reaction is $PuOH^{+3} + Pu(OH)_2^{++} \rightarrow Pu^{+3} + PuO_2^{+} + H_2O + H^{+}$. (auth)

URANIUM AND URANIUM COMPOUNDS

5765

Minnesota Univ.

ANNUAL REPORT FOR JULY 1, 1951 TO JUNE 30, 1952, PART I, [ON] NEW DATA ON SYNTHESES OF URANIUM MINERALS, by John W. Gruner. Issued July 1, 1952. 25p. (RMO-983)

The experimental syntheses described are classified as hydrothermal uranyl compounds, uranyl compounds made between room temperature and the boiling point of water, and pitchblende (uraninite) produced between room temperature and 217°C.

5766

ACTIVITY COEFFICIENTS OF URANYL FLUORIDE FROM FREEZING POINT DEPRESSIONS; UNDISSOCIATED SPECIES AND DIMERIZATION. James S. Johnson and Kurt A. Kraus. J. Am. Chem. Soc. 74, 4436-9(1952) Sept. 5.

Freezing point depressions of aqueous uranyl fluoride solutions were obtained in the region 0.1 to 5 molal UO_2F_2 by a warming-curve method. A thermistor was used as the temperature sensitive element in an automatically recording system. Activity coefficients of UO_2F_2 were calculated from these data. From these it can be concluded that uranyl fluoride in the concentration range studied is essentially undissociated and has a considerable tendency to associate. A dimerization constant K = 1.5 was evaluated for the reaction $2UO_2F_2 \rightarrow (UO_2F_2)_2$ on the assumption that the logarithm of the activity coefficients of the monomer and dimer vary linearly with molality of UO_2F_2. (auth)

ENGINEERING

HEAT TRANSFER AND FLUID FLOW

5767

Los Alamos Scientific Lab.

TWO PHASE FLOW OF HYDROGEN IN HORIZONTAL TUBES, by John D. Rogers. [nd] 85p. (AECU-2203; LADC-1242

An estimation of the pressure drop and vapor composition resulting from liquid-H_2 transfers over a range of conditions, developed with respect to present-day knowledge of two phase flow, has been undertaken. Rigorous equations are used, and calculations as functions of the parameters: diameter, ⅜ to 4 in.; mass rate, 4.4×10^{-3} to 0.42 lb/sec; pressure, 14 to 30 psia; gas composition, 0.005 to 0.775 weight fraction; and heat leak, equivalent to 0 to 4.4×10^{-3} Btu/ft-sec for a ¾-in. line have been made. (auth)

5768

Carbide and Carbon Chemicals Co. (K-25)

EFFICIENCY OF A HEAT EXCHANGER USING SQUARE FINS ON ROUND TUBES, by H. Zabronsky. Issued Aug. 15, 1952. 16p. (K-929)

Formulas are obtained for the temperature and fin efficiency of a heat exchanger consisting of round tubes with square fins. Curves are presented for the fin efficiency as a function of tube radius, all other parameters remaining fixed, and also for the temperature distribution in one particular fin. (auth)

5769

FURTHER EXPERIMENTS ON EVAPORATION FROM SMALL, SATURATED, PLANE AREAS INTO A TURBULENT BOUNDARY LAYER. D. R. Davies and T. S. Walters. Proc. Phys. Soc. (London) B65, 640-5(1952) Aug. 1.

This paper describes an experimental investigation designed to evaluate the effect of width and length on rates of evaporation from small, saturated, plane, rectangular areas placed in a turbulent boundary layer. An approach is made to the problem of estimating the distribution of temperature on the evaporating surface by using a number of thermojunctions situated at various points under the surface. The higher rate of evaporation near the edges of the area is well illustrated by this method, greater temperature differences between the surface and air stream being observed near the edges due to greater latent heat effects. Provided the cross-wind width of the evaporating area is not less than about half the downwind length, Sutton's two-dimensional solution of this limited area problem is found to lead to tolerable accuracy in the circumstances tested. (auth)

PUMPS

5770
Carbide and Carbon Chemicals Co. (K-25)
MAGNETIC PUMPS FOR CORROSIVE GASES AND LIQUIDS, by F. D. Rosen. Issued Oct. 31, 1951. Decl. with deletions Aug. 28, 1952. 11p. (AECD-3441; K-833)

A magnetically operated pump has been constructed and used successfully to pump a mixture of UF_6 and HF gases at pressures up to 175 psia and temperatures up to 100°C. (auth)

VACUUM SYSTEMS

5771
Naval Medical Research Inst., Bethesda
A GLASS SLEEVE COUPLING, by Louis P. Cecchini. May 22, 1952. 6p. (NP-4050; Memorandum Report 52-6)

A simple glass sleeve joint is described for use in coupling components of a high-vacuum system wherein permanent glass tubing connections are undesirable. An application of the glass sleeve joint for the connection of the mass-spectrometer-tube unit and the gas-handling inlet system in the Consolidated 21-102 spectrometer also is described.

5772
AN IMPROVED VACUUM SEPTUM. John E. Wertz. Rev. Sci. Instruments 23, 448-9(1952) Aug.

The usual break-off septum used to connect one section of a glass system to another suffers from two disadvantages: (1) the capillary area after breaking is many times smaller than that of the outer tube, thus throttling the gas flow; (2) effective cleaning is prevented. An improved septum with a reentrant section in which the glass is under tension and easily broken has overcome these difficulties.

5773
A VACUUM-TIGHT SEAL BETWEEN LiF AND SILVER. R. C. Lord and R. S. McDonald. Rev. Sci. Instruments 23, 442(1952) Aug.

The technique described has been used for sealing LiF windows into a cell for measuring vacuum ultraviolet absorption spectra at liquid-He temperature. The LiF was first coated with Pt and then sealed to a Ag tube which in turn was sealed to the body of the cell. AgCl was used to make the bond between the LiF and the Ag. The large differential thermal expansion is taken up by deformation of the very thin Ag part in the manner of the well-known Housekeeper seal. Seals ½ in. in diameter were still vacuum tight as measured with a He leak detector after plunging them repeatedly into liquid N_2.

5774
A VACUUM COLD TRAP. J. Hino, D. K. Stevens, and H. E. Stauss. Rev. Sci. Instruments 23, 445-6(1952) Aug.

Simple and efficient vacuum equipment can be made if the cold trap can be mounted directly on the diffusion pump, and the vacuum chamber can be mounted in turn on the cold trap. A cold trap suitable for this purpose is described. It consists of a brass tube cooled with coiled Cu tubing, a self-pumping mixture of dry ice and acetone serving as the coolant.

MINERALOGY, METALLURGY, AND CERAMICS

GEOLOGY AND MINERALOGY

5775
Department of Mines and Technical Surveys (Canada)
ELECTRONIC CONCENTRATION WITH THE LAPOINTE PICKER BELT. PART 2. ELECTRICAL CIRCUITS FOR THE LAPOINTE PICKER, by R. D. Wilmot. July 3, 1952. 26p. (NP-4063; TR-100/52)

Two electronic circuits, as used with the Lapointe Picker Belt, are described. Geiger tubes are used as the detector elements, and active ore may be removed by either a solenoid-operated plunger or selector gate. Associated regulated voltage supplies operate from a 110-v 60-cycle source. Circuit performance may be evaluated by simple tests, but over-all Picker effectiveness is largely dependent on the dispersion of the activity in the feed. (auth)

5776
Geological Survey
VOLCANIC DEBRIS IN URANIFEROUS SANDSTONES, AND ITS POSSIBLE BEARING ON THE ORIGIN AND PRECIPITATION OF URANIUM, by Aaron C. Waters and Harry C. Granger. Aug. 1952. 63p. (TEI-170)

The possible relationships between U and V ore deposits in the Colorado Plateau and the volcanic material that in part makes up the host rocks were investigated in 1951. Volcanic debris, now altered to clay minerals, has been recognized in the Salt Wash sandstone and Brushy Basin shale members of the Morrison formation of late Jurassic age and in the Shinarump conglomerate and Chinle formation of late Triassic age. Field studies and microscopic examination of the ores indicate a relationship between the ore minerals and montmorillonite clay formed by devitrification of volcanic glass. The V hydromica formerly called roscoelite is believed to be derived from montmorillonite. It is suggested that the U and V ore deposits have a complex origin and history, and that they were emplaced during the structural deformation and igneous intrusion of early Tertiary time. The paragenetic sequence, as shown in thin sections of the ore-bearing sandstones, begins with cementation of the sand by calcite, followed by secondary enlargement of quartz grains. The new silica that formed as overgrowths on the quartz grains was probably released by devitrification of the glassy volcanic material. Later, quartz grains were dissolved, and V hydromica and U-bearing minerals were formed. The deposition of the ore minerals was probably related to a change in ground-water conditions brought about by igneous intrusion. During devitrification of volcanic ash, ground water may have leached alkalies, U, V, and other substances from the ash. The absence of blanket deposits of U and V minerals implies either (1) reactivated circulation of metal-bearing ground water; or, more probably, (2) introduction of metal-bearing juvenile waters into the ground-water system. Several additional problems must be investigated before final conclusions can be reached. (NRS abst.)

5777
Geological Survey
ORIGIN OF THE CHATTANOOGA SHALE, by L. C. Conant. July 1952. 22p. (TEI-237)

At the request of the AEC the U. S. Geological Survey investigated the geology and uranium content of the Chattanooga shale in Tennessee and parts of adjacent states. The Chattanooga is predominantly black shale, bituminous and, where fresh, tough and massive. It is commonly 35 feet or less in thickness. The Chattanooga shale is a well-sorted rock, with abundant paper-thin laminae of nearly pure quartz; it seems to have been subject to frequent gentle agitation during deposition. Beds of gray claystone, present in much of the area, are concentrated in two intervals, and have permitted a fivefold lithologic subdivision of formation. Near the top of the more conspicuous of these claystone intervals is a bed of bentonite (volcanic ash) about 1 to 2 inches thick; by its constant position it shows that the gray beds do not reflect local or shifting conditions, but resulted from some kind of widespread change in sedimentary conditions.

The most abundant mineral, quartz, constitutes about a third of the volume of the formation. Other constituents, in order of decreasing abundance, are undetermined type of clay (perhaps a hydromica), organic matter, pyrite, muscovite, and a few minor minerals. Most of the quartz grains are in the size ranges of silt and clay. The organic matter consists of spores and other plant remains, bitumen, and such phosphatic objects as bone fragments and conodonts. Phosphate nodules a few inches in maximum diameter are common at and near the top of the shale. Several lines of evidence suggest that the black mud accumulated in a stagnant sea that spread slowly over a remarkably smooth continental surface in a region far removed from sources of abundant sediment. The black muds started accumulating close to shore soon after submergence, in water that must have been hardly more than knee-deep, and throughout Chattanooga time the sea was shallow, very likely less than 100 feet in depth. (auth)

5778
Geological Survey
SECOND OCCURRENCE OF BAYLEYITE IN THE UNITED STATES, by T. W. Stern and Alice Dowse Weeks. July 1952. 5p. (TEI-243)

The mineral bayleyite was first described in 1951 from the Hillside mine, Yavapai County, Ariz. This report describes bayleyite, with its mineralogic properties and associated minerals, from the Hideout No. 1 mine, San Juan County, Utah.

5779
Geological Survey
LOS GIGANTES SE, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA, by J. D. Strobell, Jr. Aug. 1952. 2p., 1 illus. (TEM-429)

A map, in preliminary form, is presented showing, roads, drainage, meridians and parallels, triangulation stations, and air-photo centers and wing points. It is transmitted in order to assist personnel in their search for U deposits in the area.

5780
GEOCHEMISTRY. Michael Fleischer and John C. Rabbitt. Ann. Rev. Nuclear Sci. 1, 465-78(1952).

New developments in mineralogy, economic geology, abundance and distribution of radioactive elements, and geologic age determinations are reviewed. Developments are specifically reviewed on U oxides, secondary U minerals, Th-bearing minerals, geographic location of U mineral deposits, radioactive elements in rocks, radioactivity of water waters, geothermal significance, and age estimations by means of Pb-U-Th ratios, He, Sr, Pb, A, K, C, and N_2. 111 references.

METALS AND METALLURGY

5781
Columbia Univ., School of Mines
THE STUDY OF DIFFUSIONLESS PHASE CHANGES IN SOLID METALS AND ALLOYS; PROGRESS REPORT FOR MARCH 1 TO MAY 31, 1952, by T. A. Read, M. W. Burkart, J. Intrater, M. Wechsler and D. S. Lieberman. [nd] 2p. (NYO-936)

A 50 at. % single-crystal specimen of Au-Cd was quenched to room temperature after having been annealed for thirty min at 450°C. With a double-crystal spectrometer the variation of rocking curve width of 100 and 200 reflections was observed at 35°C as a function of time after quench. The widths for the two reflections increased in the same manner but the percentage spread in sin θ did not. This was interpreted to indicate that the broadening of the lines with time after quench is due to a spread in the orientation of mosaic blocks rather than a spread in the value of the lattice constant. The effect of stress on the fcc-fct transformation in an In-Tl alloy (20.75% Tl) was studied. A figure shows the shift in transformation temperature on heating and cooling resulting from the application of a compressive load. It was found possible to make the specimen transform completely from one phase to the other at a constant temperature by the application and removal of a compressive load. A stress-strain diagram showing the transformation at 72.5°C is given.

5782
Massachusetts Inst. of Tech.
SOLID SOLUTIONS AND GRAIN BOUNDARIES; TECHNICAL PROGRESS REPORT NO. 12, SCOPE II, by L. L. Seigle, M. Cohen, and B. L. Averbach. Aug. 4, 1952. 37p. (NYO-3807)

Free energies, enthalpies, and entropies of mixing of Ni-Au solid solutions containing 5-95 at. % Ni have been determined by the emf method at 700 to 900°C. The thermodynamic activities exhibit large positive deviations from Raoult's law, and the entropies of mixing are almost twice those of ideal solutions. The enthalpies of mixing are positive (heat is absorbed) and are attributable to the lattice distortional energy resulting from the size difference between the Ni and Au atoms. This factor appears to be responsible for the miscibility gap at lower temperatures. (auth)

5783
Battelle Memorial Inst.
SECOND INTERIM REPORT ON THE EFFECT OF MICROSTRUCTURE ON THE MECHANICAL PROPERTIES OF TITANIUM ALLOYS TO WATERTOWN ARSENAL, by F. C. Holden, D. J. Maykuth, H. R. Ogden and R. I. Jaffee. June 27, 1952. 37p. (NP-3980)

The work covers the general theory of the strengthening mechanism involved in alpha-beta alloys. The addition of a beta-stabilizing element to Ti results in a system in which alpha, alpha-beta, and beta structures may be produced by control of the alloy additions and heat-treatments. As a result, the effects of a number of microstructural variables on mechanical properties can be studied with a single alloying element. For this study, manganese was chosen as the beta-stabilizing addition because the Ti-Mn system has been well established over the range of interest. The tensile properties of the alloys tested and the impact energy values are tabulated.

5784
SELF-DIFFUSION IN SOLID SODIUM. II. THE EFFECT OF PRESSURE. N. H. Nachtrieb, J. A. Weil, E. Catalano, and A. W. Lawson. J. Chem. Phys. 20, 1189-94(1952) Aug.

Hydrostatic pressure is found to decrease the rate of self-diffusion in Na. The free energy of activation is a linear function of the melting point, and the enthalpy of activation is proportional to the melting point. For Na and for all cubic metals (except Pb and W) for which diffusion data exist the enthalpy of activation is related to the latent heat of fusion by the equation $\Delta H = 16.5\ L_m$. The change in D_0 for Na with pressure is expressible in terms of the compressibility and the activation entropy change. (auth)

5785
SELF-DIFFUSION IN SOLID SODIUM. I. Norman H. Nachtrieb, Edward Catalano, and John A. Weil. J. Chem. Phys. 20, 1185-8(1952) Aug.

Measurements with tracer Na^{22} are reported for the self-diffusion of solid Na over the temperature range, 0 to 95°C. The data fit the empirical equation $D = 0.242 \exp(-10{,}450/RT)$ with an uncertainty of ±300 cal/mole in the heat of activation. The entropy of activation calculated from the temperature coefficient of the elastic modulus is in agreement

with the value based upon the vacancy mechanism. (auth)

5786
THE GROWTH FROM THE MELT OF SINGLE CRYSTALS OF LOW MELTING POINT METALS. A. J. Goss and S. Weintroub. Proc. Phys. Soc. (London) B65, 561-72(1952) Aug. 1.

The results of a series of experiments on the preparation of Sn, Pb, Zn and Bi single crystals in the form of rods are given. The effects on the crystallization of various thermal factors, in particular the temperature gradient and the rate of growth, are studied, and the results for the four metals are compared. (auth)

5787
PROGRESS IN METALLURGY. B. A. Rogers and F. H. Spedding. Ann. Rev. Nuclear Sci. 1, 441-64(1952).

The brief review of metallurgical developments includes the following: the effect of nuclear irradiation on the properties of metals, new measurements on the physical properties of Th and U, data on the alloys and compounds of Th and U, the application of radioisotopes to metallurgical investigations, three metals of interest in reactor design, and a brief abstract of reports on liquid metals that could be considered usable as heat exchangers. 66 references.

PHYSICS

5788
Los Alamos Scientific Lab.
LOW TEMPERATURE THERMAL EXPANSION OF PLASTICS, by Henry L. Laquer and Earl L. Head. [nd] 23p. (AECU-2161; LADC-1230(Rev.))

The thermal expansions of a number of commercially available plastics have been measured between 20 and about 350°K. The results are presented in tabular form as an aid in the design of cryogenic equipment. (auth)

5789
Research Lab. of Electronics, Mass. Inst. of Tech.
QUARTERLY PROGRESS REPORT [FOR PERIOD ENDING JUNE 1, 1952], by J. B. Wiesner. July 15, 1952. 95p. (NP-4007; U23347)

The following studies are reported: electron-emission problems, physical electronics of the solid state, experimental techniques of physical electronics, electron collision losses at low energies, electron-ion recombination in H_2, density and temperature by probes, soft-x-ray vacuum spectrograph, microwave study of semiconductors, magnetic dipole interactions in crystals, resistance minimum in metals, the Zeeman effect in an asymmetric molecule, hyperfine structure of Cs^{134}, ionic beam magnetic resonance method, microwave tubes, multipath transmission, statistical theory of communication, human communication systems, displacement of visual sense in task of obstacle avoidance, communication biophysics, neurophysiology, semantic information and its measures, and computer technology.

5790
Atomic Energy Project (Canada)
RECENT DEVELOPMENTS IN BETA-DECAY THEORY AND THE INTERACTION BETWEEN PARTICLES OF SPIN ONE-HALF, by M. A. Preston. Aug. 29, 1951. 29p. (NRC-2611)

This report is based on two lectures given at Chalk River during August, 1951. In the first chapter a rather formalistic discussion of β-decay theory and interactions between fermions is presented. An attempt is made to derive theoretically a universal interaction between fermions. In the second chapter experimental results on the values of coupling constants are discussed to see if the interaction between all fermions is of the same type.

5791
Radiation Lab., Univ. of Calif., Berkeley
SUMMARY OF THE RESEARCH PROGRESS MEETING OF JUNE 19, 1952, by Bonnie E. Cushman. July 11, 1952. 4p. (UCRL-1877)

Crystal Structure of YCl_3. G. Carter. Study of YCl_3 is of interest because its crystal structure is the same as that of the chlorides of the heavier rare earths. Density measurements indicate four Y and 12 Cl atoms per unit cell. The crystal is monoclinic with six layers along the b axis and cleavage quite marked in the b plane. There is a two-fold symmetry perpendicular to a mirror plane in the direction of the b axis. The structure and parameters, almost identical with those of $AlCl_3$, are listed. Further Identification of the Reaction $p + d \rightarrow \pi^+ + t$. K. Bandtel. Angular and energy correlations of the π-t coincidences in the reactions $p + d \rightarrow \pi^+ + t$ are shown, where both the π^+ energy and t energy are determined by the π^+ angle.

5792
THE MAGNETIC PROPERTIES OF SUPERCONDUCTING ALLOYS OF INDIUM AND THALLIUM. W. F. Love, E. Callen, and F. C. Nix. Phys. Rev. 87, 844-7(1952) Sept. 1.

Magnetization curves for spherical samples of a series of alloys in the solid-solution range of Tl in In have been measured as a function of temperature and composition, and critical-field curves have been obtained. These alloys show a fairly strong Meissner effect, and the breadth of the transition region increases for increasing Tl content. Alloys of high Tl content were found to have magnetic properties strongly sensitive to mechanical shock while in the intermediate state. (auth)

5793
A NEW THEORY OF LIQUID HELIUM. H. N. V. Temperley. Proc. Phys. Soc. (London) A65, 619-28(1952) Aug. 1.

A model of liquid helium is described, which incorporates the main features of the Landau and London theories, making use also of Mayer's concept of clusters. The ordinary process of liquefaction is associated with the formation of clusters in coordinate space, while the λ-transition is probably associated with the formation of small clusters in momentum space. The latter process is probably prevented, or greatly modified, in He^3. Possible reasons for the appearance of superfluid effects are given, and it is suggested that the unique properties of He II may be traced to the fact that the interactions between two atoms is of about the strength needed to form a molecule. (auth)

5794
AN OPTICAL CELL FOR USE WITH LIQUID HELIUM. William H. Duerig and Irving L. Mador. Rev. Sci. Instruments 23, 421-4(1952) Aug.

A low-temperature cell is described that permits spectral absorption and emission measurements, as well as high-energy irradiation of materials held at liquid-He temperatures. The liquid-He capacity of 1 liter is sufficient for up to 24 hr of continuous operation. Any substance whether it be solid, liquid, or gas at room temperatures can be studied. The all-metal cell is entirely portable and can be employed with a number of instruments without modification. A sylphon bellows arrangement permits vertical displacement within the cell of the samples under study. (auth)

5795
LOW TEMPERATURE PHENOMENA. C. T. Lane. Ann. Rev. Nuclear Sci. 1, 413-40(1952).

The properties of He^3 and He^4 between 0°K and 2.19°K are reviewed. The property of superconductivity and methods of obtaining ultra-low temperatures are reviewed. 40 references.

5796

HOW TO GET SAMPLES DATED. Nucleonics 10, No. 8, 21(1952) Aug.

Determination of the age of samples by the radiocarbon dating method has proved to be quite useful. The requirements as to sample preparation of four laboratories equipped to perform dating services are listed. (auth)

AEROSOLS

5797

A PHOTOELECTRIC METHOD OF TIMING FREELY FALLING PARTICLES. E. B. Christiansen and Dee H. Barker. Rev. Sci. Instruments 23, 427-30(1952) Aug.

A method of timing particles, falling freely in a fluid medium, is described. The method utilizes the light reflected from a particle as it passes the fields of view of two photomultiplier cells. The method has been used in a study of shape and density effects on settling rates of particulate matter in air and in water.

COSMIC RADIATION

5798

CORRELATION OF COSMIC-RAY IONIZATION MEASUREMENTS AT HIGH ALTITUDES, AT SEA LEVEL, AND NEUTRON INTENSITIES AT MOUNTAIN TOPS. H. V. Neher and S. E. Forbush. Phys. Rev. 87, 889-90(1952) Sept. 1.

Although fluctuations in cosmic rays have been measured at sea level and high altitudes for a number of years, no serious attempt seems to have been made to correlate the two. As a result of a rather long series of balloon flights in the summer of 1951 it now becomes possible to correlate ionization measurements at high and low altitudes. Recent neutron-intensity measurements during the same period by Simpson et al. (Phys. Rev. 85, 366(1952)) permit a further comparison with this component. There seems to be a good correlation, during this period of observation, between the fluctuations as measured in (1) the ionization at 70,000 ft over North Dakota, (2) the meson component at Cheltenham, Maryland, (3) the meson component at the geomagnetic equator, and (4) the neutron component at mountain tops in Colorado and New Mexico. (auth)

5799

THE ANGULAR AND LATERAL DISTRIBUTION FUNCTIONS FOR THE NUCLEON COMPONENT OF THE COSMIC RADIATION. H. Messel and H. S. Green. Phys. Rev. 87, 738-47 (1952) Sept. 1.

A method is developed whereby the angular and radial distribution functions for the nucleon component of the cosmic radiation in the atmosphere may be obtained in terms of the moments of the distributions. Essentially the method consists of an expansion of the unknown distribution functions in a series of derivatives of the Dirac delta-function, whose coefficients are identified with the angular and radial moments. The method gives results identical with those obtained by a more tedious procedure, and is of general applicability in reconstructing distribution functions when only their moments are known. The angular and radial distribution functions are found for various initial conditions, and numerical results are given for the case of an integral primary-proton power-law spectrum with exponent $\gamma = 1.1$. Variation of atmospheric density with height is taken into account. Using a form of the differential cross section for nucleon-nucleon collisions predicted by most field-theoretic treatments, it is shown that the calculated results are in disagreement by an order of magnitude with experimental data. The various assumptions on which the theory is based are then critically examined. It is concluded that the theory can be reconciled with experiment only when the number of scattered particles decreases exponentially from the direction of motion of the incident particle in the laboratory frame of reference. Using this result, the new angular and radial distribution functions are then calculated and found to be given at sea level essentially by $\exp\{-166U(1-C)\}$ and $\exp\{-3.72U^{1/2}r\}$, respectively, for particles of energy greater than U bev, where C is the cosine of the angle with the shower axis and r is the distance in kilometers from the shower axis. The half-value of the radial distribution occurs at a distance of 92 m from the shower axis. (auth)

5800

CASCADE THEORIES WITH IONIZATION LOSS. H. Messel and R. B. Potts. Phys. Rev. 87, 759-67(1952) Sept. 1. (cf. NSA 5-5997).

Analytical solutions have previously been given for the number distribution functions and for the general moments of the electron-photon and nucleon cascades neglecting ionization losses (approximation A). Solutions are now given for the moments of the electron-photon and proton-neutron cascades taking into account energy loss, via ionization, by electrons and protons (approximation B). The diffusion equations for the differential moment functions, which yield the required factorial moments by a simple integration over the energy variables, are transformed by Laplace-Mellin transforms to matrix recurrence relations, the general solution of which is obtained in the form of power series. From these series, solutions for the moments in a form suitable for numerical calculations are obtained by a generalization of the method used by Bhabha and Chakrabarty for the first moments of the electron-photon cascade and by Messel in the proton-neutron cascade. To a first approximation, the solutions for the moments in approximation B are expressed as a correction factor multiplying the solutions obtained in approximation A. (auth)

5801

ELECTRON-NUCLEAR AND EXTENSIVE ATMOSPHERIC COSMIC-RAY SHOWERS. Yu. V. Anishchenko, G. T. Zatsepin, L. L. Rozenthal, and L. I. Sarycheva. Zhur. Eksptl' i Teoret. Fiz. 22, 143-51(1952) Feb. (In Russian)

Electron-nuclear showers were found to be generated not only in heavy elements (Pb), but in light (C). In electron-nuclear showers of high energy, nuclear-active particles were observed which were capable of initiating secondary electron-nuclear showers, thus directly confirming the existence of the nuclear cascade process. The density of the nuclear-active particles in extensive atmospheric showers was proportional on the average to the density of electrons. These particles had a very "tight" spatial distribution.

5802

THE ANGULAR DISTRIBUTION AND ATTENUATION OF THE STAR-PRODUCING COMPONENT OF COSMIC RAYS. N. C. Barford and G. Davis. Proc. Roy Soc. (London) A214, 225-37(1952) Aug. 21.

Some properties of cosmic rays at 3570 m have been studied by observing nuclear disintegrations in G5 emulsion under Pb absorbers. Good geometrical definition was ensured by making these absorbers in the form of inverted Pb cones of various half-angles. The nuclear-cascade process is such that the over-all attenuation in Pb of the star-producing component increases with energy, the attenuation length varying from 370 ± 30 to 210 ± 70 g/cm^2 over the range of energy responsible for the stars examined. Interpretation of the results to give the angular distribution of the star-producing radiation depends upon the nature of the cascade process. However, it is certainly more collimated than a $\cos^2\theta$/steradian distribution, where θ is the zenith angle, and may be of the form $\cos^4\theta$/steradian for the high-energy component. For the charged component alone a direct measurement gave $\cos^{5\pm1}\theta$/steradian. The rate of production in

emulsion under no absorber of all stars with three or more heavy prongs is 17.0 ± 0.4/cm³/day. (auth)

5803
PENETRATING PARTICLES IN EXTENSIVE COSMIC-RAY SHOWERS AND THE DEVELOPMENT PHASE OF THE SHOWERS. C. Milone. Nuovo cimento (9) 9, 639-41(1952) Aug. (In Italian)

The ratio R of penetrating particles in extensive cosmic-ray showers has been determined at sea level as a function of the mean density Δ of the showers. It is found that R decreases slowly as Δ increases. Comparing this result with the results of measurements performed by other authors at 3260 m altitude, it is deduced that the value of R depends on the stage of the development of the showers. (auth)

5804
ON NUCLEAR EXPLOSIONS PRODUCED BY PRIMARY PROTONS IN EMULSIONS EXPOSED IN THE HIGH ATMOSPHERE. G. Cortini, A. Manfredini, and G. Segré. Nuovo cimento (9) 9, 659-86(1952) Aug. (In English)

Nuclear explosions produced by cosmic radiation have been studied in Ilford G5 400-μ-thick emulsions, which were exposed at about 60 g/cm² from the top of the atmosphere for about 2 hr. The analysis of these stars made it possible to find out the characteristics of events produced by primary protons only. The findings, compared with theories on meson production lead to the conclusion that the plural theory is not sufficient to explain the experimental data. It seems probable that the production of mesons should have a fairly high multiplicity even for comparatively low energies (of the order of 5 bev). On the basis of the comparison of the data with those of other authors, concerning emulsions exposed at 3,500 m altitude, a rough scheme of the development of the nucleonic component in the atmosphere is suggested. The high-energy part of this component maintains approximately its spectrum and is absorbed with an absorption length of 110 g/cm². (auth)

5805
ZENITHAL DISTRIBUTION OF THE NUCLEONIC COMPONENT OF INTERMEDIATE ENERGY. P. Bassi, C. Manduchi, and P. Veronesi. Nuovo cimento (9) 9, 722-5 (1952) Aug. (In Italian)

An absorption experiment was carried out at Marmolada, Italy, elevation 2000 m, to measure the zenithal distribution of the nucleonic component of intermediate energy (~350 g/cm²). Assuming a distribution of the type $\cos^n\theta$, the authors show that n = 1.66 ± 0.33.

5806
THE NUCLEAR INTERACTIONS OF COSMIC RAYS. Raymond V. Adams. Ann. Rev. Nuclear Sci. 1, 107-36 (1952).

Experiments are described which have been designed (a) to study the particles which initiate the nuclear interactions –their identification, mean free path for interaction, their energies, their intensities, and their probable origin and (b) to study the particles which are produced in the interactions –their identifications, their mean free path for further nuclear interactions, their multiplicity of production, and other factors bearing on the nature of the nuclear event. 58 references.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5807
Carbide and Carbon Chemicals Co. (K-25)
THE USE OF LOW TEMPERATURES IN ACCURATE STRUCTURE ANALYSIS, by R. D. Burbank. Issued Aug. 27, 1952. 6p. (K-941)

The standard errors in a structure analysis are decreased both by a reduction in the ΔF's and by an increase in the curvatures of the electron density at peak centers. At low temperatures the peak curvatures are increased as a consequence of reduced thermal vibrations. It is possible that the standard errors in many organic structures could be reduced by a factor of two by recording diffraction data at low temperatures. (auth)

ELECTRICAL DISCHARGE

5808
Radiation Lab., Univ. of Calif., Berkeley
SPARKING AND X-RAYS IN A MERCURY PUMPED VACUUM SYSTEM, by W. Kilpatrick. Aug. 1952. 15p. (UCRL-1907)

Experiments are reported on 200-Mc sparking with electrodes of Rh, Cu, Au, Cr, Mo, Invar, Cu-O, Al, Sn, and graphite. The sparking follows strictly the surface gradient and does not depend on total voltage. The accompanying x-ray intensity was calibrated against an auxiliary electron current directed across the gap, and the amplitude of the x-ray bursts during a spark was measured. The data indicated that electronic transport was sufficient for discharge of the stored energy. Each metal used as electrodes indicated a finite number of inherent sparks. Mo had a very high initial x-ray background which decreased fairly rapidly toward the level of Cu or Cr, but Mo was most completely recontaminated by air. It was demonstrated that the electron-emitting surface was damaged during the actual spark. The information obtained in the present experiments is combined with that of other investigations in enumerating facts concerning the mechanism of initiation of sparking.

5809
SPARKING POTENTIALS IN A TRANSVERSE MAGNETIC FIELD. J. M. Somerville. Proc. Phys. Soc. (London) B65, 620-9(1952) Aug. 1.

A theory of sparking between parallel plates in a transverse magnetic field, put forward by Valle (Nuovo cimento 7, 174(1950)), is discussed and shown to be in qualitative disagreement with observation. By making allowance for the distribution of electron free paths, and for electron recapture by the cathode, a modified theory is produced which is in better agreement with observation. Further refinement of the theory requires an approximate expression for the first Townsend coefficient which is valid when a magnetic field is present. The possibility of obtaining such an expression is discussed. (auth)

ELECTRONS

5810
DIRAC'S NEW CLASSICAL THEORY OF ELECTRONS. Banesh Hoffmann. Phys. Rev. 87, 703-5(1952) Sept. 1.

Similarities are pointed out between Dirac's theory and certain equations belonging to the projective theory of relativity. The latter include an electromagnetic potential of fixed gauge and are such that if one reduces them to special relativity in the conventional way by taking g_{ab} to be Galilean, one can extract from them equations closely corresponding to those of Dirac's theory. However, it is shown that taking g_{ab} to be Galilean ignores quantities that may not be negligible relative to Dirac's gauge-fixing constant $k^2 = m^2/e^2$; thus, effects arising from non-Galilean g_{ab} may be important in a theory of the type proposed by Dirac. When g_{ab} is not Galilean one apparently loses the central characteristic of Dirac's theory that all electric currents have m/e of electronic value. Equations of motion are still present, however. And since the gauge-fixed electromagnetic potential can be zero without contradicting the field equations, one need not postulate an ether for the reasons that arise from Dirac's theory. (auth)

5811
THE FOCAL PROPERTIES AND SPHERICAL ABERRATION CONSTANTS OF APERTURE ELECTRON LENSES. M. M. MacNaughton. Proc. Phys. Soc. (London) B65, 590-6(1952) Aug. 1.

The focal properties and spherical aberration constants of a number of aperture electron lenses of varying diaphragm thickness and varying strength were determined numerically using potential distributions obtained (a) from a rigorous solution due to Ollendorff, and (b) on a resistor-network analogue. The focal lengths of "weak" aperture lenses of finite diaphragm thickness agree closely with those given by Davisson and Calbick's formula for the "infinitely" thin aperture lens; "strong" aperture lenses of all thicknesses show systematic deviations from this formula. The primary spherical aberration constants of diverging aperture lenses are small, and of such sign that they cannot be used for the correction of the spherical aberration of converging electron lenses. (auth)

5812
INVESTIGATION OF MAGNETIC LENSES HAVING THE AXIAL FIELD $H(0,z) = \gamma/z^n$. U. F. Gianola. Proc. Phys. Soc. (London) B65, 597-603(1952) Aug. 1.

Examination of the requirements for reducing the spherical aberration of an electron lens by modifying the field shows that the hypothetical lens field $H(0,z) = \gamma/z^n$ should have small aberrations. It is shown that the properties of a certain class of this general field configuration can be described in terms of an exact analysis. In particular, the electron optical properties of the γ/z^2 field are described in detail. The γ/z^2 field is found to have small aberrations, but practical conditions limit appreciable improvement in resolving power. The characteristics of the γ/z^3 field also are examined and are found to give little further advantage. (auth)

INSTRUMENTS

5813
Los Alamos Scientific Lab.
TRANSIENT PRESSURE RECORDING WITH A HIGH SPEED INTERFEROMETER CAMERA, by Willard E. Buck. [nd] Decl. with deletions Aug. 28, 1952. 19p. (AECD-3442; LADC-1213)

A transient-pressure recording camera with a full-scale pressure range (by changing diaphragms) of 3 to 50,000 lb/in.^{2} and an accuracy of 0.5% of full scale for any range is described. Its stability and hysteresis are such that a single static calibration suffices for years of dynamic measurements, and its frequency response varies from 10,000 to 100,000 cps, depending on the pressure range of the diaphragm used. The paper includes records of interesting applications. (auth)

5814
Atomic Energy Research Establishment, Harwell, Berks (England)
A NEW DESIGN OF FILTER FOR DRY-BOXES, TYPE D/47, by W. G. Busbridge. 1952. 5p. (AERE HP/M-34)

The memorandum describes a small filter for interposition between dry-boxes and the suction pump which is used to ensure that external leakage does not occur, so that suction lines and pumps do not become contaminated. The filter has three components in series which are designed to ensure the maximum service life consistent with high efficiency filtration. (auth)

5815
Oak Ridge National Lab.
DESIGN OF PERCOLATORS, by S. H. Jury. July 9, 1951. 25p. (CF-51-7-41)

Non-linear kinetics due to curved adsorption isotherms, the nature of experimental data which are required for design and the redistribution of solute in adsorbent beds due to intermittent operation is outlined. The percolator design and efficiency are discussed.

5816
A HODOSCOPE UNIT WITH THE NEON LAMPS NORMALLY OFF. R. Arce, J. García de la Noceda, and A. Cobas. Rev. Sci. Instruments 23, 441-2(1952) Aug.

In cosmic-ray experiments, operation of a hodoscope unit with the neon lamps normally off and the camera shutter kept open has often been unreliable because of a failure of the neon lamps to strike after being kept in the dark for >15 min. This difficulty has been overcome by incorporating a GE 4W Ozone lamp shielded with an ultraviolet-transmitting filter so that it illuminated the neon lamps without shining on the camera film. The camera lens was covered with an orange-transmitting film.

5817
A PRECISION MEGOHM RATIO UNIT FOR HIGH VOLTAGE MEASUREMENTS. John N. Harris. Rev. Sci. Instruments 23, 409-13(1952) Aug.

A precision megohm ratio unit consisting of 100 resistance units wound of manganin wire is described. Stability of the order of a few parts per million is achieved through careful construction. Variations due to temperature changes are reduced by operating the resistor in a circulating oil bath maintained at a temperature of 33°C, where the temperature coefficient of the resistor is essentially zero. The resistor is capable of continuous operation at a potential of 5 kv and intermittent operation up to 25 kv. A general method is also reviewed for setting up accurate resistance ratios by comparing two groups of resistors in appropriate series and parallel arrangements. Employing this method and using the units of the described megohm ratio unit, high ratios, consistently accurate to one part per million, have been set up. (auth)

5818
THE 6BN6 GATED-BEAM TUBE AS A FAST COINCIDENCE CIRCUIT. Joachim Fischer and John Marshall. Rev. Sci. Instruments 23, 417-20(1952) Aug.

The performance of the 6BN6 gated-beam tube as a fast coincidence circuit for short positive pulses is investigated experimentally. Design considerations are discussed and curves of performance are shown. Resolving times better than 3×10^{-10} sec have been observed with pulses from a mercury-switch pulser. The circuit is simple and reliable in operation. It has been applied to coincidence measurement of pulses from photomultipliers. (auth)

ISOTOPES

5819
Argonne National Lab.
CONCERNING THE POSSIBLE OCCURRENCE OF Si^{32} IN NATURE, by A. Turkevich and A. Tompkins. June 1951. Argonne National Lab. and Institute of Nuclear Studies, Univ. of Chicago. Decl. with deletions Aug. 27, 1952. 2p. (AECD-3439; ANL-WMM-945)

It has been suggested that Si^{32} might be a β-stable nuclide and occur in natural Si in small, as yet undetected, amounts. Some negative results of neutron activation experiments to detect this nuclide are reported. An upper limit of $\sim 2 \times 10^{-9}$ is found for the product (abundance of Si^{32} in natural Si) × (Cross section of Si^{32} in barns). The thermal neutron absorption cross section of Si^{32} is estimated to be 5×10^{-2} barns with an uncertainty of a factor of 10, which indicates that the abundance of Si^{32} in nature is less than 4×10^{-6}%.

5820
MASS AND RELATIVE ABUNDANCE OF ISOTOPES. Alfred O. Nier. Ann. Rev. Nuclear Sci. 1, 137-56(1952).

Isotopic masses and abundances determined in 1950 by

various methods are reviewed. Mass spectrographic and mass spectrometric determinations of mass values and the electrical method for isotopic abundance values are discussed. New methods of mass measurement are described, including the omegatron, the chronotron, the synchrometer, and microwave spectra. 87 references.

ISOTOPE SEPARATION

5821
CHEMICAL SEPARATION OF STABLE ISOTOPES. G. H. Clewett. Ann. Rev. Nuclear Sci. 1, 293-300(1952).

Usually, where large quantities of isotopes are desired and cost must be considered, attention is directed toward chemical means of separation. Chemical exchange systems for separation of stable isotopes of light elements are reviewed. Four criteria to be met in chemical exchange processes for isotopes separation are discussed. They are (a) the element should be distributed between two phases, (b) rapid isotopic exchange must take place between the chemical forms in the two phases, (c) the equilibrium constant of the isotopic exchange reaction must be other than unity, and (d) means of achieving total reflux at the top or bottom of the the plant must be provided. 28 references.

5822
IONIC HYDRATION: AN ISOTOPIC FRACTIONATION TECHNIQUE. Harold M. Feder and Henry Taube. J. Chem. Phys. 20, 1335-6(1952) Aug.

The connection between ionic hydration and fractionation of the O isotopes of H_2O has been investigated. Enrichment of CO_2 by the reaction H_2O^{18} (soln.) + $CO_2^{16} = H_2O^{16}$ (soln.) + $CO^{16}O^{18}$(g) was measured at 4 and 25°C in various chloride and perchlorate solutions. The enrichment effect varies with ionic charge, radius, and type in a qualitatively reasonable way.

5823
ELECTROMAGNETIC SEPARATION OF STABLE ISOTOPES. C. P. Keim. Ann. Rev. Nuclear Sci. 1, 263-92 (1952).

Calutron separation of isotopes, calutron ion sources, calutron isotope collectors, charge materials for production of ions, calutron operation procedures, chemical purification of separated isotopes, chemical and mass analysis of separated isotopes, number of isotopes processed and enriched in the calutron, and uses of stable isotopes are reviewed. 215 references.

MASS SPECTROGRAPHY

5824
Carbide and Carbon Chemicals Co. (K-25)
THE CONSTRUCTION OF A MASS SPECTROMETER USING DIATRON-20 ANALYZER TUBE, by Henry S. McKown. Issued Aug. 28, 1952. 17p. (K-942)

A general description of the Consolidated Engineering Company's Diatron-20 mass spectrometer tube and auxiliary circuits is given for use as an analytical mass spectrometer. Data are given on the resolution, mass range, and precision that can be expected from the instrument. (auth)

5825
Naval Medical Research Inst., Bethesda
DECREASE OF N^{15}/N^{14} RATIO MEASUREMENT AS A FUNCTION OF PUMP-OUT TIME FOR THE NIER-TYPE ISOTOPE-RATIO MASS SPECTROMETER, by James Zorzy. Jan. 30, 1952. 12p. (NP-4049)

The presence of organic background peaks was observed in the operation of a Nier-type isotope-ratio mass spectrometer following experimental shut-down periods. Modifications of the manifold and analyzer-tube vacuum systems were made by installing dry-ice traps in a position immediately preceding the forepumps. As a result of these changes the obscuring effect of organic peaks on the N^{15}/N^{14} ratio measurements was decreased. Attention is called to the possibilities of error in the measurement of natural abundances of isotopes, when organic-fluid diffusion pumps are used. (auth)

MATHEMATICS

5826
THE QUANTUM-MECHANICAL PARTITION FUNCTION. H. S. Green. J. Chem. Phys. 20, 1274-81(1952) Aug.

An exact evaluation is attempted of the quantum-mechanical partition function for an assembly of similar particles with central interaction. Quantum-mechanical analogs of the classical cluster integrals are derived and evaluated as far as required to determine the virial coefficients. It is shown that the results are particularly well adapted for computation at very low temperatures. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

5827
[Sandia Corp.]
RUBBER HYDROCHLORIDE FILM AS A REPLACEMENT FOR NYLON FILM FOR RADIATION DETECTING INSTRUMENTS, by W. B. Leslie. Aug. 12, 1952. 4p. (AECU-2205; Technical Memorandum No. 5-52-15)

Air-filled proportional or ionization-type α-radiation-detecting instruments are usually covered on the open face with a thin conductive film of material. Due to the low penetrating ability of α particles, it is essential that the film be extremely thin and hence quite fragile. A determination of certain properties of rubber hydrochloride film indicates that it possesses advantages over nylon film which is presently used. Rubber hydrochloride is more resistant to puncture, easily decontaminated with alcohol, more transparent to α particles, more stable at higher temperatures, and unaffected by high humidity. (auth)

5828
Atomic Energy Research Establishment, Harwell, Berks (England)
A MASS SPECTROMETER ION SOURCE FOR SOLID MATERIAL, by G. H. Palmer and K. L. Aitken. June 6, 1952. 10p. (AERE G/R-953)

A mass-spectrometer ion source is described where the material under analysis is normally in a solid form of very low vapor pressure at room temperature. Well-collimated, monoenergetic ion beams of the order of 10^{-11} or 10^{-12} amp are obtainable, which makes the source suitable for use in a single focusing instrument of six-inch radius of curvature. Some typical analyses are given of lead and uranium. (auth)

5829
Ames Lab.
A MULTICHANNEL PULSE HEIGHT ANALYSIS SYSTEM UTILIZING PHOTOGRAPHIC RECORDING ON 35mm. FILM, by D. J. Zaffarano, F. I. Boley, and W. A. Hunt. Aug. 4, 1952. 27p. (ISC-253)

A system is described for obtaining quantitative amplitude distribution data from electronic apparatus yielding pulses of varying heights visually observable with a cathode-ray oscilloscope. The addition of a circuit which intensifies the top of each flattened pulse before display permits photographing the events with a 35-mm moving-film camera. An automatic electromechanical "reader" is described which will scan the resulting film and produce a printed record of the number of events in each of 100 or more discrete "channels," with an accuracy comparable to the best available from other "kicksorting" schemes. A spectrum of 100,000 events may be obtained from 100 feet of film. The application of the system to scintillation and proportional counter spectroscopy is discussed. (auth)

5830
National Bureau of Standards
QUARTERLY PROGRESS REPORT OF THE OFFICE OF BASIC INSTRUMENTATION, FOR THE QUARTER ENDING MARCH 31, 1952. [nd] 70p. (NBS-1753)

Progress is reported on the following projects: cathode-ray-oscillograph beam intensification, determination of temperature with a noise thermometer, medical physics instrumentation, physiological monitor, electron interferometer, mass spectrometer, photomultiplier, CO_2 hypsometer, measurement of vibration amplitudes, strain and displacement gages, vacuum tube accelerometer, ultrasonic velocimeter for liquids, acoustic viscometer for gases, microwave hygrometer, mutal inductance transducer, application of feedback around image-scanning systems, spring transducer, pneumatic instruments based on critical flow, instrumentation for dynamic mechanical measurements, instruments using magnetic effects on mechanical vibrations, and humidity measurement by spectroscopic methods.

5831
RCA-Victor Div., Radio Corp. of America
RESEARCH INVESTIGATION OF IONIZATION CHAMBERS; FINAL REPORT FOR MAY 1, 1951–APRIL 30, 1952, by J. R. Parker. [nd] 159p. (NP-3984)

An investigation of ionization chambers was made with a view toward obtaining chambers which may be used as the detecting element of integrating-type instruments for the measurement of γ and x radiation. The behavior of nitrogen and the rare gases as ionizing media is determined for gamma radiation over the quantum energy range of 0.06 to 1.25 Mev at pressures from 1 to 10 atm. This behavior is described by a "specific ionization" factor whose units are amp/cc/atm./r/hr. The data include the wall contribution of a 5.5-mm-thick nylon chamber having an inside diameter of 52.2 mm and an effective volume of 116 cc. Co^{60}, Nb^{95}, Cr^{51}, and In^{114} serve as gamma sources at 1.25, 0.758, 0.293, and 0.192 Mev, respectively. Radiation at effective energies of 0.120, 0.102, and 0.06 Mev is obtained from selectively filtered x rays. Dosage is determined by placing a specially calibrated 0.01-r Minometer at the test-chamber position. The response of chambers having walls of steel, aluminum, and brass is determined. Attempts to isolate the wall contribution are described. Work on a prototype chamber having walls of a suitable casting resin is described. These walls have metallic liners which are first electroformed on the inner part of the mold before pouring the casting resin. Response data are shown for argon in a chamber having a 0.006" nickel wall. (auth)

5832
Oak Ridge National Lab.
GENERAL PRINCIPLES OF A PROTON RECOIL FAST-NEUTRON SPECTROMETER, by B. R. Gossick. [nd] 62p. (ORNL-1283)

A general equation for calculating the neutron energy spectrum from proton-recoil counting data is derived. This equation is optimized subject to a constant total error to determine the most favorable experimental conditions. Feasible accuracy is illustrated by presenting a family of curves of the counting time (required for one point on a spectrum) plotted against total error with source intensity as a parameter. The calculations apply only to a "good geometry" experiment with a point source. The subject is treated for the most part in terms of a thin radiator, but the calculations apply equally well for the case of a thick radiator by a simple extension which is outlined. (auth)

5833
Oak Ridge National Lab.
INSTRUMENT RESEARCH AND DEVELOPMENT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JANUARY 20, 1952. Issued Sept. 8, 1952. 23p. (ORNL-1335)

Progress is reported on development of a 20-channel pulse analyzer, a slow-neutron time-of-flight spectrometer, and a small-velocity servo for a curve analyzer; on production and detection of heavy-ion beams; and on optics of polished scintillation phosphors. Adjustment of voltage distribution on the electrodes of the 5819 photomultiplier and the effect of a longitudinal magnetic field on the resolution of a 5819-NaI scintillation spectrometer are discussed. Pulse spectra produced in SnI_2-activated LiI phosphors by slow neutrons and by γ rays are illustrated. Li_2SnO_3 activated with 1 mole % TiO_2 was found to be a good neutron-sensitive phosphor, and a NaI scintillation counter was found to have a certain sensitivity to 30- to 100-kev neutrons. A new linear amplifier for scintillation spectrometry, a logarithmic sweep circuit for use in pulse-height analysis, and the feasibility of photomultiplier detection of ionizing events in a gas are discussed. Design and performance of a fluorophotometer for U determination, a medium-power frequency converter, a portable fast-neutron survey instrument, a condenser-type ionization chamber, and an x-ray-diffraction spectrometer are described briefly.

5834
Atomic Energy Project, Univ. of Calif., Los Angeles
THE USE OF A PHOTOMULTIPLIER SCINTILLATION TUBE AS A SAFEGUARD DEVICE FOR Co^{60} SOURCE, by Jacob E. Dietrich and William R. Kennedy. Issued Aug. 25, 1952. 9p. (UCLA-219)

As an additional safety device for a Co^{60} source, an electronic instrument has been designed and constructed in order to warn the operators when the radiation level is unsafe in the working chamber. Personnel doing irradiation experiments must insert samples into the working chamber through an opened lead door either by hand or with tongs. Although a number of safety interlocks have been provided in the apparatus, there is a possibility that the Co^{60} may become detached from its support rod and fall into the working chamber. While ionization chamber instruments are utilized when the working chamber door is opened, there still exists a potential hazard for accidents to occur. The instrument described makes use of a scintillation photomultiplier tube as the detecting element, which triggers a thyratron-tube-controlled relay whose contacts actuate warning lights. (auth)

5835
ON PLASTIC SCINTILLATION PHOSPHORS. Robert M. Kloepper and M. L. Wiedenbeck. Rev. Sci. Instruments 23, 446-7(1952) Aug.

Details of preparation of scintillation phosphors by polymerization of solutions of p-terphenyl, stilbene, or anthracene in polystyrene are presented. Formation of bubbles was troublesome, but could usually be removed by vigorous shaking or by heating to 200°C for a few hours, depending on the stage of polymerization. Testing for uniformity and absorption of the scintillator emission spectrum is described.

5836
MEASUREMENT OF NATURAL C^{14} ACTIVITIES IN PROPORTIONAL COUNTERS. V. Faltings. Naturwissenschaften 39, 378-9(1952) Aug. (In German)

Counting the low-intensity C^{14} activity of natural substances in the gaseous state requires working under pressure and in the proportional region. A steel-walled counter tube is described briefly, and the dependence of counting rate on voltage (4.7 to 6.6 kv) is plotted for C^{14}- and T-labeled ethylenes at 2.7 atm. pressure. The counting rate for the T preparation is shown to be independent of pressure over the range 1.1 to 4.4 atm.

5837
ERADICATION OF PROTON TRACKS IN G5 NUCLEAR EMULSION. L. Winand and C. Beets. Bull. soc. roy. sci. Liège 21, 115-18(1952) Mar. (In French)

After Ilford G5 emulsions had been exposed to protons of up to 15 Mev energy, the latent image was effaced by heating the emulsions for 50 hr at 35°C in a humid atmosphere. The emulsions then were developed, and the variation of grain density with depth was graphed for proton tracks of various energies. Effacement proceded most rapidly on that section of the track in which the proton had been traveling most rapidly.

5838
A SIMPLE AUTOMATIC COUNTER. G. A. Shirn and E. S. Wajda. Nucleonics 10, No. 9, 30-1(1952) Sept.

An inexpensive system for automatically counting and recording the activity of many samples over long periods of time has been developed. Design and operation of the system is described in detail.

5839
STATUS OF NEUTRON DOSIMETRY. H. H. Rossi. Nucleonics 10, No. 9, 26-7(1952) Sept.

Present devices for measuring tissue dose delivered by neutrons of any energy are equally sensitive to γ radiation. Instruments that are insensitive to electromagnetic radiation can be used only in a limited range of neutron energies. Problems in dosimetry of fast and slow neutrons are discussed.

5840
SCINTILLATION COUNTING TECHNIQUES. Hartmut Kallmann, Milton Furst, and Miriam Sidran. Nucleonics 10, No. 9, 15-17(1952) Sept.

Merits of the counting, integrated-intensity, and storage methods for obtaining dose and dose rate of high-energy radiation are discussed. Intensities of 10^{-6} r/hr can be measured by the first two methods; the third can indicate as little as 10^{-3} r even after a considerable lapse of time.

5841
DISCRIMINATION AGAINST NOISE IN SCINTILLATION COUNTERS. R. J. T. Herbert. Nucleonics 10, No. 8, 37-9 (1952) Aug.

The gating system described depends for its efficiency on phosphors with particular decay rates. It offers the convenience of a γ counter that requires no cooling and in which photomultiplier noise is reduced by a factor of 250 at normal operating voltages. (auth)

5842
PULSE-AMPLITUDE ANALYSIS IN NUCLEAR RESEARCH. II. SINGLE-CHANNEL DIFFERENTIAL ANALYZERS. A. B. Van Rennes. Nucleonics 10, No. 8, 22-8(1952) Aug.

Circuits for a simple sweep-type, a moderate-precision, and a precision pulse analyzer are illustrated. Operating principles and design requirements are discussed. (auth)

5843
NEUTRON-DETECTING PHOSPHORS. James Schenck. Nucleonics 10, No. 8, 54-6(1952) Aug.

Testing of over 300 phosphor samples has led to the development of a variety of scintillators containing Li. Previous experimental work and suggested methods for producing neutron-induced luminescence are reviewed.

5844
TWO NEW PHOTOMULTIPLIERS FOR SCINTILLATION COUNTING. M. H. Greenblatt, M. W. Green, P. W. Davison, and G. A. Morton. Nucleonics 10, No. 8, 44-7(1952) Aug.

The type H-5037 tube is designed for efficient collection of light from a large crystal, and the type 4646 for counting events involving extremely short time intervals. Their design and applications are discussed. (auth)

5845
LIQUID SCINTILLATION BETA COUNTER FOR RADIOACTIVE SOLIDS. Otto Blüh and Fred Terentiuk. Nucleonics 10, No. 9, 48-51(1952) Sept.

Activities less than 10^{-3} μc have been measured in the counter described. Use of larger-than-usual samples is permitted. A wide variety of solid materials can be accommodated for both multiple-sample and volume counting.

MESONS

5846
Radiation Lab., Univ. of Calif., Berkeley
PHOTOPION PRODUCTION, by Richard Madey. June 27, 1952. 53p. (UCRL-1856)

Photopion production experiments are reviewed from an experimental point of view. The experimental results and their limitations are discussed for both charged and neutral pions. (auth)

5847
Radiation Lab., Univ. of Calif., Berkeley
PRODUCTION OF NEUTRAL MESONS BY 340 Mev PROTONS ON HYDROGEN (thesis), by Joseph W. Mather. July 23, 1952. 55p. (UCRL-1893)

The production of neutral mesons by 340-Mev protons on H has been measured directly by detecting a single γ ray from a 2-γ-ray-decay neutral meson, at 90° to the proton beam. A liquid-H target and a focusing Cherenkov counter are described. The ratio of the cross section for neutral meson production from H relative to C is $\sigma_H/\sigma_C = 0.0059 \pm 0.0009$ per nuclei, where the error is standard deviation. Using the absolute cross section of neutral meson production from C as 1.5×10^{-27} cm^2, the neutral meson production cross section for hydrogen is found to be 8.8×10^{-30} cm^2. The transition $^3P \rightarrow {}^1S$ (allowed by the conservation of angular momentum and parity) for the protons can be interpreted as a triplet p-state interaction with the virtual emission of an s-state neutral meson before the usual s-state scattering of the two initial protons. The agreement with the existing data at proton energies of 440 Mev is good. The 340- and 440-Mev data give two points on the neutral meson excitation function curve, showing a steep rise. The experimental results give some evidence for the breakdown of the approximate selection rule which forbids the emission of s-state neutral mesons with final s-state nucleons. The relative cross section for C and N indicates that the yield of neutral mesons is due to the interaction of the incident protons with the neutrons in the nuclei. (auth)

5848
ELASTIC π-CARBON SCATTERING. D. C. Peaslee. Phys. Rev. 87, 862-5(1952) Sept. 1.

Elastic scattering of 60-Mev π mesons on carbon is analyzed to determine the following qualitative features of elementary π-nucleon scattering at this energy: p-wave scattering is predominant, with some s-wave interference at a relative phase that favors backscattering. The rather crude interpretation does not indicate d-wave scattering. Spin-flip scattering is essentially absent from the C^{12} scattering. The Coulomb interference provides an absolute calibration, from which it is inferred that the p-wave "resonance" energy lies above 60 Mev. (auth)

5849
THE ABSORPTION OF A π^- MESON FROM THE K-SHELL OF H^3. Saul A. Basri. Phys. Rev. 87, 866-70(1952) Sept. 1.

The branching ratio R of the nonradiative to radiative absorption of a π^- meson by H^3 is calculated on the basis of a phenomenological pseudoscalar weak-coupling theory. In order to make R independent of many unknown quantities, it is calculated by means of the formula $R = (R_n/R_\gamma)R_D$, where

$$R_n \equiv W(\pi^- + T \rightarrow 3N)/W(\pi^- + D \rightarrow 2N),$$

$$R_\gamma \equiv W(\pi^- + T \rightarrow 3N + \gamma)/W(\pi^- + D \rightarrow 2N + \gamma),$$

and R_D is the corresponding branching ratio in deuterium, whose experimental value is 2.36. Here W stands for the transition probability per unit time. Using the closure approximation, it is found that $R_\gamma = 0.41$. The value of R_n is

calculated by means of reasonable assumptions about the Fourier transforms of the initial- and final-state wave functions and is found to be 2.72. From these values it follows that R = 15.7. (auth)

5850
HEAVY MESONS. J. G. Wilson. Nuovo cimento (9) 9, Suppl. 1, 90-7(1952). (In English)

The present experimental situation with regard to mesons heavier than the π meson is discussed. The following particles appear to exist: (1) the uncharged V_1^0 particle, which decays to a proton and negative π meson, and is regarded as an excited nucleon; (2) the uncharged V_2^0 particle, the least-known of the heavy mesons, which decays to two single charged particles, probably both lighter than nucleons, and possibly a third, uncharged particle; (3) a charged particle of ~1200-m_e mass, which is identical with both $V^{\pm}$ and κ mesons and is indicated as the ($V\kappa$) particle; probable modes of decay are ($V\kappa$) $\rightarrow \mu + \pi^0 + \nu$ or $\mu + \nu + \nu$; (4) a charged particle of ~970-m_e mass, the τ meson, which decays to three π mesons; and (5) the ξ particle, not discussed further, which probably decays to two π mesons. The S particle is not mentioned. 12 references.

5851
S-PARTICLES. M. Annis, H. Bridge, H. Courant, S. Olbert, and B. Rossi. Nuovo cimento (9) 9, 624-7(1952) July. (In English)

An event observed in a multiplate cloud chamber operated at 3260-m altitude and triggered by a penetrating-shower detector is illustrated. The existence of a particle of mass 1420 (+910, −450) m_e decaying at rest into charged secondaries heavier than electrons and with kinetic energies of the order of 100 Mev is indicated. Other cases of decay of these "S particles" have been observed. The particle is probably identical with the κ meson and possibly with the charged V particles.

5852
EXCITATION OF NUCLEI BY ABSORPTION OF π^- MESONS. I. GENERAL CONSIDERATIONS. G. Puppi, V. De Sabbata, and E. Manaresi. Nuovo cimento (9) 9, 726-33(1952) Aug. (In Italian)

The authors investigate the excitation of a nucleus A = 100 due to the capture of a π^- meson bound in the lowest orbit. The model used implies the absorption of the π^- by a pair of nucleons of a Fermi gas at zero temperature. The process is divided into two phases: a first one, practically instantaneous, which takes place between the absorption act and the instant in which the two little avalanches originating from the point in which the absorption took place reach the nucleus surface: a second one in which the particles that were not instantaneously released heat the nucleus, which becomes disexcited through an evaporation process. Two-thirds of the total energy absorbed is instantaneously released and about one-third (52 Mev) is evaporated. The energy becoming visible in form of ionizing particles is about 40 Mev. The mean number of neutrons is ~1.75 and the spectrum is very rich at the very low energies (<10 Mev). The problem has been solved using the Monte Carlo method. Further details and a comparison with experimental results will be published in a forthcoming paper. (auth)

METEOROLOGY

5853
GROUND-LEVEL MEASUREMENTS OF OIL-FOG EMITTED FROM A HUNDRED-METER CHIMNEY. P. H. Lowry, D. A. Mazzarella, and M. E. Smith. Meteorol. Monographs. 1, No. 4, 30-5(1951) Nov.

The meteorological control program instituted at Brookhaven National Laboratory in 1947 includes a complete study of dispersion from an elevated source by means of an oil-fog test effluent. Measurements of oil-fog concentrations at ground-level have been made during a wide variety of meteorological conditions. The data accumulated in the first forty-six tests are summarized in this paper, together with pertinent meteorological information. A brief description of terrain, facilities, and procedures is also included. (auth)

MICROWAVES

5854
Research Lab. of Electronics, Mass. Inst. of Tech.
ZEEMAN-EFFECT MEASUREMENTS ON MICROWAVE SPECTRA; TECHNICAL REPORT NO. 225, by J. R. Eshbach and M. W. P. Strandberg. Feb. 4, 1952. 12p. (NP-4006; Technical Report No. 225; U23437)

Apparatus and experimental techniques for Zeeman-effect measurements on microwave absorption spectra are described. The method uses a wave-guide-type absorption cell and provides for either π- or σ-type observations. Molecular rotational and nuclear gyromagnetic ratios were measured to about 1% accuracy. A method is also presented for sign determination of these gyromagnetic ratios using circularly polarized microwaves. The microwave components used in setting up the circularly polarized waves are described. (auth)

MOLECULAR PROPERTIES

5855
Duke Univ.
QUARTERLY PROGRESS REPORT; MICROWAVE RESEARCH; FOR FEBRUARY 1, 1952–FEBRUARY 29, 1952, by Walter Gordy. [nd] 20p. (NP-3936)

The structure of bromoform has been evaluated entirely from microwave spectroscopy. The B_0 values in Mc of the isotopic species studied are: 1247.61 ± 0.025 for $CHBr_3^{79}$; 1217.30 ± 0.025 for $CHBr_3^{81}$; 1239.45 ± 0.025 for $CDBr_3^{79}$; 1209-51 ± 0.025 for $CDBr_3^{81}$. These constants yield the structure as follows: d_{CH} = 1.07 ± 0.01 A, d_{CB} = 1.930 ± 0.003 A, angle BrCBr = 110°48′ ± 16′. In addition, brief abstracts of the following current projects are presented: dipole moments of several molecules from their microwave spectra, microwave investigations of $HSiCl_3$ and CH_3SiCl_3, a simple Stark-modulation microwave spectrograph, and paramagnetic resonance in U salts.

NEUTRONS

5856
Radiation Lab., Univ. of Calif., Berkeley
CROSS SECTIONS FOR PRODUCTS OF 90 MEV NEUTRONS ON CARBON (thesis), by D. A. Kellogg. July 29, 1952. 96p. (UCRL-1899)

Determinations have been made of the cross sections for the products of 90-Mev neutrons on C in the case of practically all reactions that occur. Beta counting of the activities generated in a rotating polyethylene disc yielded cross sections for the production of some heavy fragments, identified as to isotope and atomic number. Cloud-chamber study yielded cross sections for almost all reactions, but resulted in the identification of most of the heavy fragments only by atomic number. The rotating-disc-method cross sections were normalized to the $C^{12}(n,2n)C^{11}$ cross section, and the cloud chamber method cross sections were normalized to the n-p cross section. (auth)

NUCLEAR PHYSICS

5857
Atomic Energy Project (Canada)
NUCLEAR TWO-BODY INTERACTIONS, by J. David Jackson. July 25, 1950. 53p. (NRC-2395; LT-28)

A series of lectures presents a brief discussion of the

theory of the nuclear two-body problem and summarizes what is known at present about the forces between nucleons. Only the forces between pairs of nucleons are considered, and a general description of the forces is given without recourse to meson-nuclear theories.

5858
Atomic Energy Project (Canada)
THE PRINCIPLE OF DETAILED BALANCING IN ATOMIC AND NUCLEAR PHYSICS, by J. D. Jackson. Aug. 1951. 34p. (NRC-2610; LT-32)

These notes form the text of a series of three lectures on the principle of detailed balancing given during the summer of 1951. The aim of the lectures was to discuss the basis for the principle of detailed balancing and to gather together representative relations in atomic and nuclear physics which arise from its application. Experimental material has been included only in so far as it provides a direct quantitative verification of detailed balancing. In the first part, an outline is given of the ideas of detailed balancing in classical statistical mechanics, the foundation of detailed balancing on time-dependent perturbation theory, and its application to atomic physics, in particular to the radiative lifetimes of excited states in atoms. In the second section, the modifications necessary for nuclear physics are indicated, and application is made to inverse reactions, particle widths, and radiation widths.

5859
THE ELECTRON-NEUTRON INTERACTION. L. L. Foldy. Phys. Rev. 87, 693-6(1952) Sept. 1. (cf. NSA 5-6861).

The known electromagnetic properties of nucleons, assuming that the electron-neutron interaction is fundamentally of electromagnetic origin, are fitted into the phenomenological framework developed in the preceding paper (Phys. Rev. 87, 688(1952); NSA 6-4283), and the results are compared with predictions of weak-coupling meson theories. The detailed comparison shows that the intrinsic electron-neutron interaction is somewhat smaller than predicted, and it is suggested that even in the more favorable cases the rough agreement as to order of magnitude may be largely due to a fortuitious cancellation of different contributions, which may easily be upset when higher-order effects are included in the theory. Even apart from the detailed calculations, it is indicated that the observed intrinsic electron-neutron interaction is considerably smaller than order-of-magnitude expectations from general meson-theoretical principles. The results emphasize the importance of more accurate experimental determinations of the electron-neutron interaction, since a smaller value of the intrinsic interaction will either pose a very stringent test for any meson theory or require a critical re-evaluation of our present ideas regarding nucleonic structure. Some phenomena related to the electron-neutron interaction and the possibility that the intrinsic interaction may be nonelectromagnetic in origin are briefly discussed. (auth)

5860
HIGHER APPROXIMATIONS TO THE INTERNUCLEON POTENTIAL. Gernot Eder. Acta Phys. Aust. 5, 404-13(1952) Mar. (In German)

The interaction potential between nucleons is derived according to the symmetric, charged, and neutral theories on the basis of vector-meson interaction. The discussion is limited to the potential contributions of second and fourth order in the coupling constants.

5861
SHELL STRUCTURE OF THE ATOMIC NUCLEUS. Theodor Sexl. Acta Phys. Aust. 5, 330-5(1952) Mar. (In German)

The author recalls his pioneer presentation of the fundamentals of the nuclear shell structure; namely, determination of the nucleon terms on the basis of a simple potential-well model and splitting of these terms into inverted doublets.

5862
MEDIUM-ENERGY NUCLEAR PHYSICS. Katharine Way. Nucleonics 10, No. 9, 46-7(1952) Sept.

Some trends in current thinking on nuclear structure, angular correlation, magnetic moments, isotopic spin conservation, etc., as discussed at a conference on medium-energy nuclear physics held June 5, 6, and 7 at the University of Pittsburgh, are summarized.

NUCLEAR PROPERTIES

5863
Argonne National Lab.
THE THERMAL NEUTRON CAPTURE CROSS-SECTIONS OF Pa^{231} AND Pa^{232}, by R. Elson, P. A. Sellers, and E. R. John. June 1952. Decl. Aug. 28, 1952. 3p. (AECD-3436; ANL-WMM-990)

The cross section of Pa^{231} for capture of pile neutrons, determined by the measurement of the U^{232} formed by the β decay of the Pa^{232} initially formed, was found to be 293 barns with an uncertainty of the order of 15%. The thermal neutron capture cross section of Pa^{232}, determined by estimation of the amount of Pa^{233} formed in the reaction $Pa^{232}(n,\gamma)Pa^{233}$, was found to be of the order of $40(^{+40}_{-20})$ barns.

5864
Radiation Lab., Univ. of Calif., Berkeley
SUMMARY OF THE RESEARCH PROGRESS MEETING OF MAY 29, 1952, by Sergey Shewchuck. July 10, 1952. 4p. (UCRL-1872)

Low-Energy Properties of Nuclear Forces. R. Jastrow. The first two terms of the pseudoscalar interaction are known to vary as $e^{-\mu r}/r$. The 4th order has been calculated and found to be a term $\sim e^{-\mu r}/r^{3/2}$ with a sizeable coefficient. This shows a high singularity and a short range, hence dominates at small distances. An attempt was made to check these forces in five cases with known experimental values of the low-energy constants. Calculations were made over a range of coupling constants from $g^2/4\pi = 10 \rightarrow 13 \rightarrow 16$. The results are shown for a pseudoscalar coupling constant of $g^2/4\pi = 13$. (cf. UCRL-1722)

Relation of Low Energy Meson Scattering Experiments to Nuclear Forces. M. Ruderman. Some general remarks are made on the success of the above nuclear force calculations in the low-energy region for the pseudoscalar meson theory with pseudoscalar coupling.

5865
COSINE INTERACTION BETWEEN NUCLEONS. A. de-Shalit. Phys. Rev. 87, 843(1952) Sept. 1.

Some properties of a nuclear interaction proportional to $(\vec{j}_1 \cdot \vec{j}_2)$ are investigated. Although this interaction yields, qualitatively, resonable results for even-even nuclei, it fails when applied to odd nuclei, the situation being similar to that in the long-range Majorana interaction. (auth)

5866
THE 7.4-MEV STATE OF Li^7. Murray Peshkin and A. J. F. Siegert. Phys. Rev. 87, 735-7(1952) Sept. 1.

Blair and Holland have reported preliminary measurements of the cross section for the $Li^6(n,\alpha)$ reaction as a function of the neutron energy, Roberts et al. (Phys. Rev. 82, 299(1951)) have measured the angular distribution of the tritons for a neutron energy of 270 kev. Assuming that the nonresonance part of the cross section is due entirely to s-neutrons and that there is no accidental degeneracy of the resonance state, this state is shown to have spin ½. Experiments which might test the assumptions are discussed. A note added in proof states that Dr. Roberts has recently informed the authors that his preliminary result may require revision. Any effect of this revision on the conclusions of the present paper can be seen by substituting the revised coefficients into the equations given in the present paper.

5867

THE STRUCTURE OF LITHIUM 6. A. J. M. Hitchcock. Proc. Phys. Soc. (London) A65, 661-2(1952) Aug. 1.

The energies of the lowest states of Li^6 have been calculated from the standpoint of the shell model, using recent data for the proton-neutron forces. It is concluded that it is necessary to take into account the tensor force in discussing the lowest states of this and other odd-odd nuclei. (auth)

5868

RECENT DEVELOPMENTS IN THE THEORY OF NUCLEAR STRUCTURE. E. Feenberg. Ann. Rev. Nuclear Sci. 1, 43-66(1952).

This paper is a review of many recent publications on the theory of nuclear structure. Phases of work discussed include magnetic moments and L-S coupling for odd mass number, quadrupole moments of odd mass nuclei, comparative half lives and spectral shapes in β decays, configuration analysis, spins of odd-odd nuclei and β-decay selection rules, electric dipole transitions, and configuration interaction and shell structure. 82 references.

5869

ENERGY LEVELS OF LIGHT NUCLEI. T. Lauritsen. Ann. Rev. Nuclear Sci. 1, 67-96(1952). (cf. NSA 3-404).

This review discusses the known energy levels of nuclei with 20 particles or fewer. The arrangement of energy levels is described, but the problems of accounting for the observed arrangement is unsolved. 62 references.

5870

NUCLEAR MOMENTS. Norman Ramsey. Ann. Rev. Nuclear Sci. 1, 97-106(1952).

The important developments in the field of nuclear moments taking place in 1950 are reviewed. New methods of measuring nuclear moments, newly discovered phenomena associated with nuclear moment measurements, theoretical interpretations, and new moment measurements are reviewed. 115 references.

NUCLEAR REACTORS

5871

Oak Ridge National Lab.

A LOW COST EXPERIMENTAL NEUTRON CHAIN REACTOR; PART I, by William M. Breazeale. Issued Apr. 15, 1952. Decl. Aug. 13, 1952. 58p. (AECD-3435; ORNL-1105(Rev.))

A description is presented of a low-cost reactor suitable for installation in schools or other research institutions as a tool for experiments requiring a source of neutrons as a laboratory device for educational purposes. Discussions of T. H. J. Burnett on health physics instruments, by H. C. Claiborne and H. F. Poppendiek on transient thermal behavior, and by Arnold R. Olsen on corrosion of Al-clad fuel elements are appended.

5872

Brookhaven National Lab.

THE DEPENDENCE OF REACTOR KINETICS ON TEMPERATURE, by J. Chernick. Dec. 20, 1951. 41p. (BNL-173)

The effect of temperature on reactor kinetics is treated in a nonlinear form. The general character of the solutions is established first by elementary means. Thus some information on the extreme of the solution curves is obtained directly from the form of the differential equations. The singular points of the temperature equation are then discussed by the method of Poincaré. By use of the method of isoclines, the solution curves are sketched in the phase plane for various values of the arbitrary parameter involved in the differential equation, the values being selected to illustrate changes in the phase portrait. Solutions of finite form are obtained for special values of the parameter. Comparison of these solutions with series obtained by perturbation or iteration methods points up some of the defects inherent in the use of the latter methods. The second part of the investigation deals with the problem of representing the solution of the differential equation for all values of the parameter and under arbitrary initial conditions. A time-series representation is developed which avoids many of the convergence problems associated with more conventional perturbation or iteration methods. Despite the fact that the differential equation possesses only two singular points, a multiplicity of mathematical forms is required for the series representation, depending on the value of the arbitrary parameter and in some cases on the initial conditions as well. The convergence of the general series in a region about a stable equilibrium point is proved for major cases of interest. It is shown that there generally exist two solutions of especially simple form through a saddle or nodal singularity (stable or unstable). In some cases it is possible to show that the series representation of these solutions is valid throughout the phase plane. The possible extensions of the method are discussed. The final section is a study of the possible existence of periodic solutions of the temperature equation.

5873

THE ELEMENTS OF NUCLEAR REACTOR THEORY. Samuel Glasstone and Milton C. Edlund, eds. N. Y., D. Van Nostrand, Inc., 1952. 416p.

The fourteen chapters of this textbook progress from the fundamentals of nuclear structure and reactions, through neutron behavior and reactor control, to transport theory. The material is intended for the use of physicists, engineers, and others being brought into the reactor program. The present form is a revision of the preliminary draft, issued in 1950, that was developed from lectures by M. C. Edlund at the Oak Ridge School of Reactor Technology.

5874

TRANSFER FUNCTION OF ARGONNE CP-2 REACTOR. J. M. Harrer, R. E. Boyar, and Darwin Krucoff. Nucleonics 10, No. 8, 32-6(1952) Aug.

The kinetic behavior of CP-2 has been determined for sinusoidal variations of reactivity. Variations of phase and amplitude of the neutron density have been both measured and calculated, the experimental apparatus is illustrated, and details of the calculation are given.

NUCLEAR TRANSFORMATION

5875

Rochester Univ.

ANNUAL PROGRESS REPORT FOR JUNE 1, 1951—MAY 31, 1952 ON SPALLATION REACTIONS, by Wade Callender, Albert A. Caretto, Jr., Bruce Dropesky, Richard W. Fink, Alan A. Goerlitz, Clarence G. Heininger, Genevieve Wagner, and Edwin O. Wiig. [nd] 13p. (NYO-704)

Investigations are being made of the spallation, fission, and secondary reactions occurring when the elements Co, V, Y, I, Ni, Cs, and Ta are bombarded with high-energy protons. The effect of proton energy on relative yields of Fe^{52}, Mn^{52}, Mn^{51}, Mn^{56}, Cl^{39}, $Cl^{38,34^7}$, and F^{18} from Co is being studied; Mn^{51} has been observed as a product activity for the first time. The only short-lived activity observed following 96-Mev bombardment of Ni was 40-min Zn^{63} formed by the secondary reaction Ni^{60} (α,n). The following nuclides have been definitely identified following 230-Mev proton bombardment of V: V^{48}, Ti^{45}, $Sc^{47,46,44m,44}$, $Ca^{45,47}$, K^{42}, and $Cl^{39,38,34}$; apparently present are Mn^{51}, Cr^{49}, Sc^{43}, K^{43}, and S^{35}. In bombardment of Y with 240-Mev protons two new Y isotopes, Y^{82} and Y^{83}, have been made. A rather lengthy discussion is presented of the determination of mass numbers and half lives of nuclides resulting from 240-Mev bombardment of I.

Some of the half lives are as follows: Xe^{121}, 40 ± 2 min; Xe^{122}, 19 ± 1 hr; Xe^{123}, 1.7 ± 0.2 hr; I^{121}, 1.5 ± 0.1 hr; and I^{122}, 3.4 ± 0.2 min. The data also indicate that 1.5-hr I^{121} decays directly to the lower 17-day isomeric state of Te^{121}, rather than to its 143-day upper state.

5876
Radiation Lab., Univ. of Calif., Berkeley
REACTIONS OF FAST CARBON NUCLEI IN PHOTOGRAPHIC EMULSIONS (thesis), by James Fuller Miller. July 1952. 258p. (UCRL-1902)

A study has been made of reactions produced in nuclear emulsions by the 112-Mev C^{12} and the 121-Mev C^{13} beams from the sixty-inch cyclotron at Crocker Laboratory. The properties and expected behavior of C nuclei as bombarding particles are discussed in the light of the reactions observed. An analysis is made of the salient features, both general and special, of 865 stars produced by 1,390,000 C^{12} ions and of 1114 stars produced by 1,845,540 C^{13} ions. The comparative reaction cross sections are discussed in some detail. The cross section is calculated for the total range as given by any initial energy and also for the differential range, as a function of the instantaneous energy. A further breakdown is made for the cross section as it depends on the number of prongs. Three- and four-prong star cross sections are higher for C^{12} than for C^{13} and exhibit a detailed structure. Analysis shows the structure arises from impact disintegration and stripping of the carbon nucleus; these reactions account for the C^{12} ion larger cross section —0.446 barns for 110-Mev C^{12} compared to 0.388 barns for 120-Mev C^{13}. The instantaneous cross section of C nuclei nearly equals the available geometric cross section for inelastic reactions until neutron-evaporation events from Ag and Br reduce the number of charged-particle stars. The outstanding special type of reaction found is the impact disintegration of the C nucleus into three α particles and the closely related stripping and capture of an α particle from the C nucleus by the target nucleus. These reactions are explicable on the basis of the modern α-particle model of the C nucleus, the low energy required to break up the C nucleus, especially C^{12}, and the short de Broglie wave length of the C particle which permits a collision to be concentrated on a single α particle. A number of impact disintegrations and strippings are analyzed in detail to bring out the interesting features of the reaction. Observations are made regarding Be^8, one of the fragments in the reaction before it breaks into two α particles. Fission produced by C^{13} ions in Bi-impregnated emulsions is discussed. Nine fission events were found from 1,702,600 tracks. The indicated cross section for fission is half the available reaction cross section. Range-energy data for C ions have been obtained. Above 40 Mev, C and α particles are directly compared by passing them through slits. Below 40 Mev, data are obtained from knock-on protons. Comparisons are made of carbon ions with fission fragments and with light particles. (auth)

5877
Radiation Lab., Univ. of Calif., Berkeley
EXCITATION FUNCTION FOR PHOTONEUTRON PRODUCTION FROM 80 TO 320 MEV (thesis), by Lawrence Jones. Aug. 13, 1952. 56p. (UCRL-1916)

The excitation functions for neutron production by high-energy quanta were investigated for 11 elements. By varying the maximum energy of the x-ray beam of the Berkeley synchrotron, photoneutron yields were obtained at eight maximum bremsstrahlung energies from 40 to 320 Mev. The beam was monitored with the induced β activities of Cu foils at the various energies. Using a photon difference method, the yields were analyzed to give cross sections. The cross sections increased with energy for all but the lightest elements from 100 to 300 Mev. Correlations are observed between these results and results of other experiments which indicate that the cross sections for photonuclear interactions are at high energies about proportional to the atomic weight. There is evidence that a compound nucleus may be formed in heavy elements by high-energy quanta. An increase in the photon absorption cross section at energies below the meson threshold is evidence of a virtual meson type of interaction. (auth)

5878
CAPTURE OF THERMAL NEUTRONS BY URANIUM-238. J. Guéron and E. Broda. Acta Phys. Aust. 5, 414-5(1952) Mar. (In German)

The recently declassified value of 2.6 barns for the capture cross section of U^{238} is much greater than the value given by the earliest investigators (Halban et al., Compt. rend. 208, 1396(1939); Fermi and Anderson, Phys. Rev. 55, 1106(1939)). It is suggested that the possibility of Szilard-Chalmers effects was overlooked in these experiments.

5879
DERIVATION OF THE NUCLEAR SCATTERING FORMULA FROM THE THEORY OF FORCED DAMPED NUCLEAR VIBRATIONS. Stanislaus Kronenberg. Acta Phys. Aust. 5, 341-8(1952) Mar. (In German)

A derivation of the formula for the dependence of the total reaction cross section on the energy of the bombarding particle is presented.

5880
GAMMA-NEUTRON REACTIONS IN FLUORINE. R. J. Horsley, R. N. H. Haslam, and H. E. Johns. Phys. Rev. 87, 756-8(1952) Sept. 1.

The cross-sectional curves for the reactions $F^{19}(\gamma,n)F^{18}$ and $F^{19}(\gamma,2n)F^{17}$ have been determined by measurement of the induced positron activities. The (γ,n) cross-sectional curve rises almost vertically from the threshold to a value of about 2 mb, remains constant for about 3 Mev, and then increases again to a maximum value of 3.48 mb at 20 Mev. The $(\gamma,2n)$ cross-sectional curve has a peak value of 0.66 mb at about 26 Mev. The integrated cross sections for the (γ,n) and $(\gamma,2n)$ reactions are 0.039 and 0.0024 Mev-barns, respectively. However, the $(\gamma,2n)$ reaction is evaluated only up to its peak position at 26 Mev. A new value of 60 ± 1 sec is reported for the F^{17} activity. (auth)

5881
THE $Cu^{63}(\gamma,n)Cu^{62}$ CROSS SECTION. V. E. Krohn, Jr. and E. F. Shrader. Phys. Rev. 87, 685-7(1952) Sept. 1.

The cross section for the reaction $Cu^{63}(\gamma,n)Cu^{62}$ has been determined as a function of energy by the analysis of the x-ray-activation curve. D_2O-loaded emulsions and a pair spectrometer were used as monitors, and the results obtained are in good agreement with the results of recent measurements which depend upon the calculated response of r-meters. (auth)

5882
THE DISINTEGRATION OF OXYGEN AND NITROGEN BY 14.1-MEV NEUTRONS. Alan B. Lillie. Phys. Rev. 87, 716-22(1952) Sept. 1.

Oxygen and nitrogen contained as a gas in a cloud chamber were bombarded by 14.1-Mev neutrons. From the disintegrations of these nuclei the following data have been collected: (a) the range-energy relations of C^{12} in the energy range 0 to 5 Mev, and the range-energy curve of B^{11} from 0 to 7 Mev; (b) the excited states of the nuclei C^{13}, B^{11}, N^{15}, and N^{16}; (c) the angular distributions of the α particles emitted in the $O^{16}(n,\alpha)C^{13}$ and $N^{14}(n,\alpha)B^{11}$ reactions; (d) the cross sections for some of the reactions taking place. (auth)

5883
STATISTICAL ERRORS OF COEFFICIENTS OF EXPERIMENTAL ANGULAR DISTRIBUTIONS EXPANDED INTO

SPHERICAL HARMONICS. P. M. Endt. Physica 18, 421-2 (1952) June-July. (In English)

For comparison of experimentally determined angular distributions with theory an expansion into spherical harmonics may be useful. The question then arises of the order of magnitude of the statistical errors of the coefficients obtained by numerical integration from the limited number of events observed at any particular angle. A series expansion by which these errors can be calculated is derived.

5884

MULTIPLE RESONANCES IN PHOTODISINTEGRATION CROSS SECTIONS. F. K. Goward and J. J. Wilkins. Proc. Phys. Soc. (London) A65, 671-2(1952) Aug. 1.

The reactions $O^{16}(\gamma,4\alpha)$ and $C^{12}(\gamma,3\alpha)$ have been studied by irradiating Ilford nuclear emulsions with bremsstrahlung, using peak energies from 20 to 70 Mev. The results reveal multiple resonances in the dependence of the cross sections on γ-ray energy. These resonances suggest that the reaction should be interpreted in terms of the excitation of levels in a compound nucleus. The assumption of certain very narrow, discrete resonances is shown to give excellent agreement with experimental data without requirement of a continuum.

5885

MEASUREMENT OF THE RATIO OF FISSION CROSS SECTIONS BY THERMAL NEUTRONS OF Pu^{239} AND NATURAL URANIUM. II. René Cohen, Eugène Cotton, and Antoine Lévêque. Compt. rend. 235, 159-61(1952) July 16. (In French)

The recently declassified value of 664 barns for the fission cross section of Pu^{239} has cast doubt on the Pu^{239}/U thermal fission ratio of 203.3 ± 4.0 published by the authors (NSA 6-4956), since the value 796 barns would be given by this ratio. The ratio has been remeasured carefully with the result $\sigma_{Pu}/\sigma_U = 207.0 \pm 3.0$, the same as before within experimental limits. The $1/v$ law assumed for the variation of fission cross section in the thermal-neutron region may be in error.

5886

TECHNIQUES RELATED TO PRODUCTION OF Fe^{59}. Rayburn W. Dunn. Nucleonics 10, No. 8, 40-3(1952) Aug.

From methods devised for preparing high-specific-activity Fe^{59} by the cyclotron (d,2p) reaction with cobalt, various techniques have evolved for treating the probe block before and after irradiation and for preparing the purified Fe^{59} for medical use. Purity and yields are discussed. (auth)

PARTICLE ACCELERATORS

5887

Atomic Energy Project, Univ. of Calif., Los Angeles
ELECTRON GUN MODIFICATION FOR THE CONTROL OF BEAM CURRENT IN THE R. C. A. ELECTRON MICROSCOPE, by F. W. Bishop. Aug. 29, 1952. 7p. (UCLA-220)

A simple modification of the old non-biased electron gun has been made which combines the best features of a biased gun with the mechanism which allows the height of the filament to be changed while the microscope is in operation. The result is greater flexibility and ease of operation of the instrument and a reduction of the rate of contamination in critical parts of the microscope. (auth)

5888

A MULTIPLE-CAVITY LINEAR ELECTRON ACCELERATOR. Bernard L. Miller. Rev. Sci. Instruments 23, 401-8(1952) Aug.

A linear accelerator comprising five cylindrical cavities operating in the TM_{010} mode on the divided power of a 10-cm magnetron (nominally 1 megawatt) has produced electron beams up to 1.4 Mev. The first cavity is a phase buncher; the remaining ones, accelerators. Power is fed to the cavities through series tee connections to a master wave guide which is loaded with dielectric rods for adjusting the relative phases. The fields are of the order of 100 kv/cm. The maximum output has been 0.25 μamp average, 5% of the injected current. The accelerated electrons consist of a high-energy bunch containing 50% of the total output current, with the remainder of the electrons spread over the lower energies. The energy of the bunched component can be varied widely by changing the magnetron voltage and by operating with fewer cavities. This accelerator has proven a reliable research tool in a study of secondary electron emission of solids as a function of primary electron voltage over the range of 18 kv to 1.4 Mev. (auth)

5889

HIGH ENERGY ACCELERATORS; STANDARD CYCLOTRON. M. Stanley Livingston. Ann. Rev. Nuclear Sci. 1, 157-62 (1952).

Recent advances in the field of cyclotron technology are reviewed, and various techniques of cyclotron operation and instrumentation are discussed.

5890

HIGH ENERGY ACCELERATORS; SYNCHROCYCLOTRON. M. Stanley Livingston. Ann. Rev. Nuclear Sci. 1, 163-8(1952).

Recent developments in the field of synchrocyclotron technology are reviewed. Systems for emergent beam ejection which have been used or proposed are discussed. Status of synchrocyclotron development in the United States and abroad is discussed.

5891

HIGH ENERGY ACCELERATORS; PROTON SYNCHROTRON. M. Stanley Livingston. Ann. Rev. Nuclear Sci. 1, 169-74(1952).

The principle and design of the proton synchrotron are reviewed. Comparative designs of various proton synchrotrons are discussed. Design features of the Brookhaven synchrotron are described. 12 references.

5892

HIGH ENERGY ACCELERATORS; SYNCHROTRONS. J. E. Thomas, Jr., William L. Kraushaar, and I. Halpern. Ann. Rev. Nuclear Sci. 1, 175-98(1952).

The basic design features of the University of California, Cornell University, and Massachusetts Institute of Technology synchrotrons are compared. The present practice in the design and operation of large synchrotrons is summarized, with emphasis on recent advances in understanding and with some proposals for the future. The intensity, spectrum, angle of speed, and pulse duration of the x-ray beam are discussed. A list of the known synchrotrons is given. 80 references.

5893

HIGH ENERGY ACCELERATORS; LINEAR ACCELERATORS. J. C. Slater. Ann. Rev. Nuclear Sci. 1, 199-206 (1952).

At the time of writing of this paper some half dozen linear accelerator construction projects were under way. This paper reviews the design of each machine, as well as their respective states of completion. The machines discussed are the 32-Mev proton accelerator at the University of California at Berkeley, the 66-Mev proton accelerator at the University of Minnesota, the 35-Mev electron accelerator at Stanford, the 17-Mev electron accelerator at MIT, the 3.4-Mev electron accelerator at the Atomic Energy Research Establishment in England, the 10-Mev electron accelerator at Purdue, and the 4-Mev electron accelerator at Yale.

RADIATION ABSORPTION AND SCATTERING

5894

Atomic Energy Research Establishment, Harwell, Berks (England)
VARIATION OF THE KLEIN-NISHINA DIFFERENTIAL

CROSS SECTION WITH GAMMA ENERGY, by D. W. S. Smout. June 5, 1952. 9p. (AERE EL/R-892)

In γ scintillation counting it is convenient to know the distribution per unit energy range of Compton-scattered electrons. Curves are given for the determination of this distribution, based on the Klein-Nishina formula, for a range of γ energies from 0.2 to 2 Mev. The validity of the curve obtained for the 0.669-Mev γ from Cs^{137} was demonstrated experimentally.

5895

Rochester Univ.

HIGH-ENERGY PROTON-PROTON SCATTERING AND ASSOCIATED POLARIZATION EFFECTS, by L. J. B. Goldfarb and D. Feldman. July 31, 1952. 42p. (NYO-3217)

Three phenomenological descriptions of p-p scattering have been proposed to date, two of which, the singular tensor-force model of Christian-Noyes and the L·S force model of Case-Pais, are characterized by a singular triplet potential. The Jastrow model introduces a hard core in the singlet interaction. The parameters of these various potentials have all been determined, in part, by use of Born approximation estimates of triplet scattering cross sections at high energies. Inasmuch as the validity of such estimates is not clear in those cases where the interaction is singular, more exact calculations have been performed at 240 Mev with the singular potentials (and also, for comparative purposes, with the well-behaved triplet interaction of Jastrow) using Schwinger's variational method and/or numerical integration procedures. Such calculations have also been performed at 450 Mev for the singular tensor-force model. To insure the existence of solutions, a zero cut-off was introduced in the singular potentials at distances of the order of the nucleon compton wave length. It is found that, in all instances where the potential is singular, the Born approximation and the use of Born approximation trial functions in a variational treatment are completely unreliable. More exact calculations of the differential scattering cross sections than those in Born approximation introduce large anisotropies in the case of the singular interactions and, in particular, in the case of the L·S potential. The hard-core model, on the other hand, is in qualitative agreement with experiment. Also discussed are the results of calculations of polarization effects in a double p-p scattering and their implications for the various potentials considered. (auth)

5896

THE INFLUENCE OF MULTIPLE SCATTERING ON THE ANGULAR WIDTH OF ČERENKOV RADIATION. K. G. Dedrick. Phys. Rev. 87, 891-6(1952) Sept. 1.

The angle at which visible Cherenkov radiation appears from fast charged particles as they pass through a thin transparent plate can be measured. This angle is related to the velocity of the particle in a simple manner, and therefore offers a method of measuring the velocity. The angular width of the radiation is important in that it determines the resolution of the velocity measurement. This width contains contributions due to diffraction, energy loss of the charged particle, and multiple scattering. In this paper, the effects of multiple scattering and diffraction are considered in the following manner. The path of the particle through the transparent plate is considered to be a series of connected short straight-line segments. The radiation is calculated classically from this path, and with the aid of the results of multiple-scattering theory, an ensemble average is taken over all possible paths. Two different methods are used in evaluating the radiation average. One is valid at viewing angles near the radiation maximum, and the other at viewing angles differing appreciably from the maximum. Curves are presented that give the radiation intensity as a function of the viewing angle for a variety of cases. (auth)

5897

ON THE CONCEPT OF FERMI'S SCATTERING LENGTH. Theodor Sexl. Acta Phys. Aust. 5, 336-40(1952) Mar. (In German)

The Fermi scattering length $\underline{a}$ (Phys. Rev. 71, 666(1947)) is shown to be expressible in the terminology of Guth and Sexl's pioneer work on scattering of nucleons by nuclei (cf. Vorlesungen über Kernphysik, Vienna, F. Deuticke, 1948) as

$$\underline{a} = \lim_{k \to 0} \frac{iC_0}{2k} = \lim_{k \to 0} \frac{\sin\delta_0}{k} e^{i(\delta_0 + \pi)}.$$

5898

POLARIZATION OF ELECTRONS BY COMPTON SCATTERING. H. Robl. Acta Phys. Aust. 5, 319-29(1952) Mar. (In German)

The fractions of recoiling electrons having spins parallel and antiparallel to a given initial direction are calculated. It is assumed that the incident photon is unpolarized and that the recoiling electrons are independent of the polarization of the light quanta scattered by them. The derivation is limited to the case in which the spin direction before scattering corresponds to the direction of motion of the recoil electron. The polarizations of those electrons corresponding to a right-angled scattering of light quanta are investigated. A reversal of spin by a significant fraction of the electrons can occur only when the energy of the light quanta is not small with respect to the rest energy of the electron.

5899

NUCLEAR SCATTERING OF 17-MEV GAMMA-RAYS. Mary Beth Stearns. Phys. Rev. 87, 706-15(1952) Sept. 1.

The nuclear scattering of γ rays from the $Li^7(p,\gamma)Be^8$ reaction has been measured. The scatterers used were Bi, Pb, Sn, and Cu. The observed Z dependence of the elastically scattered γ rays varied as $Z^{2.5\pm0.5}$, while the inelastically scattered γ rays varied at a rate greater than $Z^{2.9\pm0.3}$. An appreciable amount of inelastic scattering was observed. The elastic-scattering results combined with previously measured integrated γ–n cross sections of Cu are in agreement with a γ-ray absorption curve centered around 17 to 18 Mev and having a width of 4 to 6 Mev. (auth)

5900

MOMENTS OF THE ANGULAR DISTRIBUTION FOR HIGH ENERGY NUCLEAR COLLISIONS. B. A. Chartres and H. Messel. Phys. Rev. 87, 748-9(1952) Sept. 1.

Detailed results for the mean square angle of scattering of nucleons in high-energy nucleon-nucleus collisions are presented using the accurate expressions previously determined by Messel and Green (Phys. Rev. 87, 738(1952)). Curves are given both for light and heavy elements. Confirmation of the results presented would provide valuable information on the differential cross section for nucleon-nucleon collisions. (auth)

5901

RECOIL CORRECTION TO BREMSSTRAHLUNG CROSS SECTION. S. D. Drell. Phys. Rev. 87, 753-5(1952) Sept. 1.

A correction to the Bethe-Heitler differential cross section for bremsstrahlung (or pair production) due to the recoil of the source of the Coulomb field (proton) is derived. Terms of order v/c, where v is the recoil velocity of the scattering center, are studied. They are shown not to contribute in the analysis of electron-proton scattering given by Schiff (NSA 6-1545). (auth)

5902

PROTON-PROTON SCATTERING AT 5 MEV BY A COINCIDENCE METHOD. R. O. Bondelid, C. H. Braden, M. E. Battat, and P. Bohlman. Phys. Rev. 87, 699-702(1952) Sept. 1.

The scattering of 5-Mev protons by protons was examined by a coincidence method. Particular attention was given to

the absolute value of the differential cross section at 45° in the laboratory system. The differential cross sections at other angles were determined relative to the cross section at 45°. The S-wave phase shift calculated from the observed cross section at 45° agrees, within the experimental error, with that from other experiments in this energy range. No indication of a P-wave effect was observed. (auth)

5903

SCATTERING OF ELECTRONS FROM POINT SINGULARITIES IN METALS. D. L. Dexter. Phys. Rev. 87, 768-77 (1952) Sept. 1.

Mott's calculations on the scattering of electrons from substitutional impurity atoms are extended to include the scattering from interstitial atoms and vacancies; the effects of lattice distortions around the singularities are taken into account. It is found that the lattice distortions do not change the order of magnitude of the calculated resistivity in most cases of practical interest, but may in some cases make a difference of a factor of three or more for substitutional atoms of the same valence as the replaced atoms. It is concluded that the resistance change due to a dissociated vacancy-interstitial pair in a monovalent metal of atomic number Z is about equal to or somewhat larger than that due to two divalent substitutional atoms of atomic number Z + 1. Changes in the temperature-dependent part of the resistivity as a result of lattice distortions are found to be of the same order, at room temperature, as the changes in the residual resistivity due to the lattice distortions. (auth)

5904

THE SCATTERING OF ELEMENTARY PARTICLES BY COMPLEX NUCLEI; A GENERALIZATION OF THE IMPULSE APPROXIMATION. Geoffrey F. Chew and M. L. Goldberger. Phys. Rev. 87, 778-82(1952) Sept. 1.

By a systematic iteration procedure it is shown how the problem of the scattering of an elementary particle by a complex nucleus (or any many-particle target system) can be expressed in terms of two-body operators. The results are related to the previous work of Chew and Wick on the impulse approximation, with special attention given to multiple-scattering effects which have heretofore not been formulated in a rigorous way. An explicit formula for the double-scattering terms is presented. (auth)

5905

ON THE UTILIZATION OF MULTIPLE SCATTERING MEASUREMENTS. D. S. Schonland. Proc. Phys. Soc. (London) A65, 640-56(1952) Aug. 1.

The determination of the product pv for particles leaving tracks in photographic emulsions is discussed on the basis of measurements of the scattering in the tracks made by the "coordinate" method (Fowler Phil. Mag. 41, 169(1950)), allowing for errors of measurement due to grain size. The use of Fowler's method with the comparatively large interval lengths used in practice is shown to be justifiable in spite of its neglect of much information contained in the track. (This neglect increases the root-mean-square error in the estimation of the scattering over the minimum attainable error by a factor less than approximately 2·6.) A possible method of estimating pv, which approximates to the "best possible," based on the use of mean squares, is considered, and the root mean square relative error in the estimation is found, the necessity for cutting off the scattering distribution at large angles being taken into account. A possible method of estimation based on the use of mean moduli also is discussed. (auth)

5906

THE SCATTERING OF POSITRONS BY NUCLEI. H. N. Yadav. Proc. Phys. Soc. (London) A65, 672-3(1952) Aug. 1.

The scattering cross sections for positrons by the coulomb fields of nuclei have been calculated for the energy range 1 to 10 Mev of the incident positrons. The method starts from Mott's formula for the differential scattering cross section. The ratios R of the differential cross sections so obtained to those obtained using the Rutherford formula were calculated. The values of R are tabulated for Z = 10 to 80 and for scattering angles of 30 to 180°.

5907

PROTON-PROTON SCATTERING AT 147 MEV. J. M. Cassels, T. G. Pickavance, and G. H. Stafford. Proc. Roy. Soc. (London) A214, 262-72(1952) Aug. 21.

An external proton beam from the 110-in. Harwell cyclotron has been used to investigate proton-proton scattering at 147 Mev. The angular distribution of the scattering has been studied from 25 to 90° and found to be isotropic, within the limits of error. The absolute differential cross section for scattering at 90° has been measured in two ways and found to be 4.94 ± 0.28 mb. The results can also be used to find the $C^{12}(p,pn)C^{11}$ cross section at 142 Mev. (auth)

RADIATION EFFECTS

5908

Knolls Atomic Power Lab.

THE EFFECT OF HIGH-INTENSITY GAMMA RAYS ON THE OPTICAL TRANSMISSION OF CERIUM-STABILIZED GLASS, by E. L. Shirley and A. D. Aird. Aug. 14, 1952. 16p. (KAPL-759)

Measurements were made of the optical transmission of cerium-stabilized glass as affected by gamma rays from the 3400-curie Co^{60} source. An initial loss in transmission of approximately 7% was experienced. One third of this 7% is recovered at room temperature within 30 minutes; after heating at 110°C this recovery is increased to better than three fourths of the 7%. (auth)

5909

Atomic Energy Project, Univ. of Calif., Los Angeles

ALPHA PARTICLE INDUCED RADIATION IN THIN FILMS, by M. A. Greenfield, Amos Norman and Paul M. Kratz. Issued Aug. 22, 1952. 7p. (UCLA-218)

The light emitted by thin films bombarded by α particles has been examined spectrographically. A Po source in air emits a line spectrum. No additional radiation was observed when the source was immersed in water. Thin films of Al, Cu, Au, desoxyribonucleic acid, and collodion bombarded by α particles emit radiation continuous from about 230 mμ to 470 mμ, the region of observation. Representative spectra are shown in photographs.

5910

RADIATION TOLERANCES AND GENETIC EFFECTS. Harold H. Plough. Nucleonics 10, No. 8, 16-20(1952) Aug.

To aid in the recognition of potentially important genetic hazards, data on direct and genetic effects of radiation on men, mammals, and Drosophila are compiled. Long-term effects of radiation on population are discussed. 39 references.

RADIOACTIVITY

5911

Los Alamos Scientific Lab.

SOFT RADIATION FROM Pu^{239}, by Harvey I. Israel. [nd] Decl. Aug. 26, 1952. 4p. (AECD-3434; LADC-1236)

The radiations from Pu^{239} in the region 5 to 25 kev have been studied by means of a proportional counter in combination with a single-channel pulse analyzer and associated circuits. By using a thin absorber of suitable material the peak resulting from the characteristic K x radiation of the absorber material was superimposed on the Pu spectrum for calibration purposes. The spectra obtained show peaks at 20.5 ± 0.4, 17.4 ± 0.3 and 13.6 ± 0.3 kev. These values agree with the observed values for the L x rays of U. The total

yield, 2.9×10^{-2} photons per α particle, is in error by not more than 50%.

5912

Vanderbilt Univ.

MEASUREMENT OF THE K AUGER YIELD OF BARIUM AND MERCURY WITH A MAGNETIC LENS SPECTROMETER (thesis), by Carter D. Broyles. July 1952. 82p. (AECU-2204)

The magnetic-lens spectrometer at Vanderbilt Univ. has been improved and used in an investigation of the K-Auger yields of Ba and Hg. The improvements made in the spectrometer and its calibration and operation are described. Very thin sources of Cs^{137} and Au^{198}, prepared by thermal evaporation in vacuo of CsCl and Au, were used to study the K-Auger yields. The yields were obtained by measurement of the relative intensities of K-conversion electrons and the K Auger electrons. In the measurements the K Auger electrons appear as three broadened lines due to the K-LL, the K-LX, and the K-XY Auger electrons (X represents the M, N, etc., orbital electrons and so does Y; K-XY represents a transition from X to K orbit and consequent electron emission from Y orbit). The K-Auger yield of Ba was found to be $a_K = 0.130 \pm 0.007$, and the ratios of the K-Auger lines were K-LL : K-LX : K-XY :: 1.00 : 0.40 ± 0.04 : 0.08 ± 0.02. The K-Auger yield of Hg was found to be $a_K = 0.054 \pm 0.008$, and the ratios of the K-Auger lines were K-LL : K-LX :: 1.00 : 0.71 ± 0.15. These values are compared with theory. A new summary, complete through June 1952, of experimental values of the K fluorescence yield is presented in an appendix.

5913

Rochester Univ.

DOUBLE BETA DECAY IN Sn^{124} AND Zr^{96}, by John A. McCarthy. Aug. 12, 1952. 19p. (NYO-3221)

If double β decay takes place without the emission of neutrinos, the total kinetic energy of the two emitted electrons will be constant. The half life would be of the order of 10^{19} yr for 1.5 Mev available energy or 10^{17} yr for 4 Mev available energy. Sn^{124} and Zr^{96} have been studied for evidence for such a process. A lower limit of 1.5×10^{17} yr is set on the half life for double β decay of Sn^{124}, which has 1.5 ± 0.4 Mev available energy. In the case of Zr^{96}, which has 4.2 ± 0.5 Mev available energy, an activity has been observed at 3.8 ± 0.5 Mev with a half life of $6 \pm 2 \times 10^{16}$ yr. Since the energy spectrum and coincidence nature of this activity agree with the theoretical predictions, the activity is tentatively attributed to double β decay. (auth)

5914

Radiation Lab., Univ. of Calif., Berkeley

INVESTIGATIONS OF ALPHA RADIOACTIVITY USING NUCLEAR EMULSIONS (thesis), by Dean Carl Dunlavey. Aug. 1952. 42p. (UCRL-1911)

Methods are described for using nuclear emulsions for α-particle counting and for the observation of α-electron coincidences. A discussion is given of investigation of α emitters by means of nuclear emulsions. An α emitter of particle energy 4.85 Mev has been found in the Bi fraction produced by the bombardment of Pb with 60-Mev protons. Half-life observations and α systematics indicate that the emitting isotope is Bi^{203}. The assignment of a Cm isotope having an α energy of 6.5 Mev has been corroborated as Cm^{238} by showing it to be the parent of Pu^{234}. Investigations have been made of complex structures in the α-particle emission of Sm^{147}, Gd^{148}, Bi^{210}, Po^{208}, Th^{232}, U^{232}, U^{233}, U^{234}, U^{236}, U^{238}, Np^{237}, Pu^{236}, Pu^{238}, Pu^{239}, Am^{241}, and Cm^{242}.

5915

DECAY SCHEMES OF ^{151}Sm AND ^{155}Eu. H. W. Wilson and G. M. Lewis. Proc. Phys. Soc. (London) A65, 656-61(1952) Aug. 1.

Examination of the relatively long-lived isotopes produced by pile irradiation of Sm using the proportional tube spectrometer leads to the elucidation of the decay schemes of Sm^{151} and Eu^{155}. The conclusions are supported by experiments involving β-e^- and β-γ coincidences, utilizing G-M and scintillation counters. (auth)

5916

EMISSION OF LIGHT POSITIVE PARTICLES BY BETA EMITTERS. Peter M. Weinzierl. Acta Phys. Aust. 5, 265-85(1952) Mar. (In German)

Various studies of β emitters have led to results uninterpretable in terms of pure electron emission by the source. Positive tracks appear repeatedly in cloud-chamber investigations, while positive and negative spectra of light particles have been observed as components of β decay. In the present paper, these observations are collected and compared, and the possibility of their interpretation is discussed. Whether a previously unknown particle exists or whether the positive tracks in cloud chambers are misinterpretations of reflected electron tracks can not be decided on the basis of present knowledge. More arguments seem to favor the former assumption than the latter. 68 references

5917

PROMETHIUM ISOTOPES. Vera Kistiakowsky. Phys. Rev. 87, 859-60(1952) Sept. 1.

The half lives and radiation characteristics of some Pm isotopes have been measured. Bombardments of isotopically enriched Nd oxide samples by 8.9 to 32-Mev protons and of Pr oxide samples by 15 to 36-Mev He ions were used to produce these nuclides. They were identified chemically and on the basis of relative yields. Nuclides studied: Pm^{141}, Pm^{142}, Pm^{143}, Pm^{144}, Pm^{146}, Pm^{149}, and Pm^{150}. (auth)

5918

HALF LIFE AND DECAY SCHEME OF Rb^{87}. Ingeborg Bähnisch, E. Huster, and W. Walcher. Naturwissenschaften 39, 379-80(1952) Aug. (In German)

Studies of the radiations from thin (~50 $\mu g/cm^2$) layers of RbCl vapor-deposited on 200-$\mu g/cm^2$ sheets of silvered zapon and mounted in a double coincidence counter failed to reveal any β-γ coincidences, suggesting that Rb^{87} decays directly to the ground state of Sr^{87}. Various half lives based on different assumptions as to backscattering coefficients are suggested.

5919

TRACING NUCLEAR EXPLOSIONS. Norman J. Holter and Wilford R. Glasscock. Nucleonics 10, No. 8, 10-13(1952) Aug.

For over 2 yr an automatic 24-hr daily record of atmospheric radioactivity has been taken at Helena, Mont. as part of a project to investigate the feasibility of remotely locating large natural U and/or Th deposits by correlating changes in local activity with wind and other meteorological data. High recordings related to natural radioactivity and to atomic explosions in Nevada, at Eniwetok, and in the U.S.S.R. are discussed. Dating nuclear explosions by decay of precipitated fission products is described.

5920

RADIOMETRIC PROPERTIES OF THE THORIUM SERIES. James Fresco, Evelyn Jetter, and John Harley. Nucleonics 10, No. 8, 60-4(1952) Aug.

Activity curves of groups in the Th series are applied as a basis for the analysis of Th and its daughter products by α and β counting, and for the calculation of approximate β surface dose rates. (auth)

SPECTROSCOPY

5921

ATOMIC AND MOLECULAR SPECTROSCOPY. G. H. Dieke. Ann. Rev. Nuclear Sci. 1, 363-412(1952).

Spectroscopic results which have some relation to the mass or structure of the nucleus or which were made possible by activities in the atomic energy field are reviewed and discussed. One-electron spectra, production and structure of atomic spectra, isotopic shifts in atoms with more than one electron, hyperfine structure, diatomic molecules, microwave spectra, r-f spectroscopy, spectra of liquids and solids, and spectrochemical analysis are reviewed. 331 references.

THEORETICAL PHYSICS

5922

ELECTRODYNAMIC DISPLACEMENT OF ATOMIC ENERGY LEVELS. III. THE HYPERFINE STRUCTURE OF POSITRONIUM. Robert Karplus and Abraham Klein. Phys. Rev. 87, 848-58(1952) Sept. 1. (cf. NSA 6-3140; 6-3833)

A functional integro-differential equation for the electron-positron Green's function is derived from a consideration of the effect of sources of the Dirac field. This equation contains an electron-positron interaction operator from which functional derivatives may be eliminated by an iteration procedure. The operator is evaluated so as to include the effects of one and two virtual quanta. It contains an interaction resulting from quantum exchange as well as one resulting from virtual annihilation of the pair. The wave functions of the electron-positron system are the solutions of the homogeneous equation related to the Green's function equation. The eigenvalues of the total energy of the system may be found by a four-dimensional perturbation technique. The system bound by the Coulomb interaction is here treated as the unperturbed situation. Numerical values for the spin-dependent change of the energy from the Coulomb value in the ground state are finally obtained accurate to order α relative to the hyperfine structure α^2 Ry. The result for the singlet-triplet energy difference is $\Delta W_{ts} = \frac{1}{4}\alpha^2\ \mathrm{Ry}_\infty[7/3 - (32/9 + 2\ \ln 2)\alpha/\pi] = 2.0337 \times 10^5$ Mc/sec.

Theory and experiment are in agreement. (auth)

5923

SELECTION RULES IMPOSED BY CHARGE CONJUGATION AND CHARGE SYMMETRY. A. Pais and R. Jost. Phys. Rev. 87, 871-5(1952) Sept. 1.

It is found that the invariance with respect to charge conjugation and charge symmetry combined leads to selection rules, additional to those following from covariance and gauge-invariance arguments. Besides rigorous selection rules which hold for certain processes involving neutral particles (mesons and photons) only, there exist weak selection rules according to which certain boson-boson transitions are less probable by a factor $e^2/\hbar c$ than the corresponding transitions in which an additional photon is emitted. The rules are stated, and some examples are given. (auth)

5924

THE NON-ADIABATIC METHOD WITH A NEUTRAL PSEUDOSCALAR MESON FIELD. D. Baroncini. Nuovo cimento (9) 9, 642-58(1952) Aug. (In English)

Dancoff's nonadiabatic procedure for the two-nucleon system interacting with a meson field is applied to the neutral pseudoscalar meson field, taking into account both types of couplings, the pseudoscalar and the pseudovector. The procedure is limited to the second order of the coupling constants. Using the hamiltonian containing the direct-interaction term, the Schroedinger equation of motion contains interaction potentials, one of which introduces into the equation a high singularity. The reason is that the term arising from the direct-interaction hamiltonian does not cancel completely with the so-called contact term, which arises from the nucleon-meson interaction hamiltonian, as is the case in the adiabatic procedure. If the direct-interaction hamiltonian is neglected from the beginning, the Schroedinger equation contains a singular potential, which corresponds to the contact term of the adiabatic approximation. This potential behaves, however, as the corresponding potential in the previous case, and not as a δ-function, as is the case in the adiabatic procedure. The remaining interaction potentials, which are the same in the two cases, are less singular than the potentials in the adiabatic procedure. In the nonrelativistic limit, the interaction functions lead to the same functions given by the conventional perturbation procedure. (auth)

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers

For a list of the abbreviations used in this section, see NSA, Vol. 6, No. 12B, page "SUPPLEMENT 1".

$_{0}N_{2}^{5}$	He^6 not produced by pile irradiation of He		A. J. Ferguson, J. H. Montague, Phys. Rev. 87, 215A(1952).
$_{1}H_{1}^{3}$	μ 0.857606 M		P. J. Bray et al., Phys. Rev. 87, 229A (1952).
H	σ_t(0.264 – 3.0 Mev) $n(\theta)$ studied		M. Walt et al., Phys. Rev. 87, 238A(1952).
	σ(th n,γ)H^3 0.57 mb		L. Kaplan et al., Phys. Rev. 87, 785(1952).
$_{2}He_{2}^{4}$	σ_{el}(90 Mev) 0.11		P. Tannenwald, Phys. Rev. 87, 205A(1952).
$_{3}Li_{3}^{6}$	σ(2.49 Mev n,α) 0.188	pc	F. L. Ribe, Phys. Rev. 87, 205A(1952).
	σ(14.2 Mev n,α) 0.026		
	σ(14.2 Mev n,d) 0.014		
	Levels 2.1 3.6	Li^6(p,p) Li^7(p,d) Li^6(p,d) scin E_p = 18.3	W. Franzen, J. G. Likely, Phys. Rev. 87, 205A(1952).
$_{3}Li_{4}^{7}$	d,$\gamma(\theta)$ and d,p$\gamma(\theta)$ = constant I(0.477 level) = ½	Li^6(d,pγ) scin E_d = 0.6 – 0.9	C. M. Class, S. S. Hanna, Phys. Rev. 87, 247(1952); Nature 168, 429(1951).
	d,p$\gamma(\theta)$ = constant I(0.477 level) = ½	Li^6(d,pγ) scin E_d = 0.5	W. H. Burke, J. R. Risser, Phys. Rev. 87, 294(1952); 85, 741A(1952).
	Levels 4.5 6.5	Li^7(p,p) scin E_p = 18.3	W. Franzen, J. G. Likely, Phys. Rev. 87, 205A(1952).
$_{3}Li_{4}^{9}$	τ 0.170^s		R. B. Holt et al., Phys. Rev. 87, 378 (1952). C^{12}(47.5 Mev p).
$_{4}Be_{3}^{7}$	d,n(θ) g.s. and 0.430 level have odd parity	Li^6(d,n) ppl E_d = 3.5	F. Ajzenberg, Phys. Rev. 87, 205A(1952).
$_{4}Be_{3}^{7}$	Level 0.430	B^{10}(p,α) EA E_p = 3.3	D. S. Craig et al., Phys. Rev. 87, 206A (1952).
$_{4}Be_{5}^{9}$	Level 2.44*	Be^9(p,p) scin E_p = 8	J. S. Arthur et al., Phys. Rev. 87, 237A (1952); *verbal report.
	Level 2.57	Be^9(p,p) a E_p = 7.4	D. B. Cowie et al., Phys. Rev. 87, 304 (1952); 85, 742A (1952).
$_{4}Be_{6}^{10}$	d,p(θ)	Be^9(d,p)	C. F. Black, Phys. Rev. 87, 205A(1952).
	d,p$\gamma(\theta)$ I(3.77 level) = 2	Be^9(d,pγ) scin E_d = 0.9	L. Cohen et al., Phys. Rev. 87, 206A(1952).
$_{5}B_{5}^{10}$	d,n(θ) First 4 states have even parity	Be^9(d,n) ppl E_d = 3.5	F. Ajzenberg, Phys. Rev. 87, 205A(1952).
	Levels 0.71 1.74 2.15 3.58 4.76	B^{10}(p,p) sr E_p = 7	W. W. Buechner et al., Phys. Rev. 87, 237A (1952).
	Level 2.34	B^{10}(p,p) a E_p = 7.4	D. B. Cowie et al., Phys. Rev. 87, 304 (1952); 85, 742A (1952).
	Level 0.719	B^{10}(p,p) EA E_p = 2.2	D. S. Craig et al., Phys. Rev. 87, 206A (1952).
$_{6}C_{6}^{12}$	σ[C^{12}(27 Mev n,2n)20^mC] ~0.01		J. E. Brolley, Jr., et al., Phys. Rev. 87, 206A(1952).
	γ 4.47 ± 0.04	Be^9(α,nγ) sl pair	D. E. Alburger, Phys. Rev. 87, 194A(1952).
	(11.8γ)(4.5γ)(θ) I(4.5 level) = 2 γ's are M1, E2	B^{11}(p,γ) scin E_p = 0.17	T. P. Hubbard, Jr., et al., Phys. Rev. 87, 378(1952).
	Level 4.44*	C^{12}(p,p) scin E_p = 8	J. S. Arthur et al., Phys. Rev. 87, 237A (1952); *verbal report.

$_{6}C^{12}_{6}$	Level		$C^{12}(p,p)$	D. B. Cowie et al., Phys. Rev. 87, 304 (1952); 85, 742A (1952).
		4.59	a	
			$E_p = 7.4$	
	Level		$C^{12}(p,p)$	H. F. Stoddart, H. E. Gove, Phys. Rev. 87, 238A(1952); 87, 262 (1952).
		4.45	scin	
			$E_p = 7.3$	
	Resonances		$B^{11}(p,n)$	H. B. Willard et al., Phys. Rev. 86, 629A (1952); 87, 206A (1952). *Double.
	3.17	4.14*		
	3.75	4.67	$E_p \leq 5.5$	
$_{6}C^{13}_{7}$	Levels		$C^{13}(p,p)$	D. B. Cowie et al., Phys. Rev. 87, 304 (1952).
		3.14	a	
		4.03	$E_p = 7.4$	
	d,p(θ)		$C^{12}(d,p)$	C. F. Black, Phys. Rev. 87, 205A(1952).
	I(ground) = $p_{3/2}, p_{1/2}$			
	I(3.1 Mev level) = $s_{1/2}$,			
	I(3.9 Mev level) = $d_{3/2}, d_{5/2}$			
			$E_d = 14.5$	
$_{6}C^{14}_{8}$	~No β^- with E <8 kev		cc	G. W. McManaway et al., Phys. Rev. 87, 176A(1952).
$_{7}N^{13}_{6}$	Resonances		$C^{12}(p,p)C^{12}$	H. L. Jackson et al., Phys. Rev. 87, 237A (1952); verbal report.
	E_p	T(kev)	J	
	0.461	35	$s_{1/2}$	
	0.696	60	$p_{3/2}$	
	1.748	66	$d_{3/2}$	
$_{7}N^{14}_{7}$	Levels		$N^{14}(p,p)$	D. B. Cowie et al., Phys. Rev. 87, 304 (1952); 85, 742A (1952).
		2.35	a	
		3.95	$E_p = 7.4$	
	Levels		$N^{14}(p,p)$	J. S. Arthur et al., Phys. Rev. 87, 237A (1952); *verbal report.
		2.33	scin	
		3.96	$E_p = 8$	
		5.10*		
	No level at 3.80*			
$_{7}N^{15}_{8}$	$\sigma[N^{15}(\text{pile n},\gamma)7.3^{S}N^{16}]$			A. J. Ferguson, J. H. Montague, Phys. Rev. 87, 215A(1952).
	0.08 mb			
$_{8}O^{15}_{7}$	Level		$N^{14}(d,n)$	W. B. Rose et al., Phys. Rev. 87, 382 (1952).
	4.9		ppi	
			$E_d = 1.7$	
$_{8}O^{16}_{8}$	Levels		$O^{16}(\gamma,n)$	R. N. H. Haslam et al., Phys. Rev. 87, 196A (1952).
	15.60	16.72		
	15.84	16.96		
	16.56			
	Levels		$O^{16}(p,p)$	D. B. Cowie et al., Phys. Rev. 87, 304 (1952); 85, 742A (1952).
	None <4.6		a	
			$E_p = 7.4$	
	γ's		$F^{19}(p,\alpha\gamma)$	D. E. Alburger, Phys. Rev. 87, 194(1952).
	6.19 ± 0.08		sl	
	7.13 ± 0.12		pair	
$_{9}F^{19}_{10}$	Levels		$F^{19}(p,p)$	D. B. Cowie et al., Phys. Rev. 87, 304 (1952); 85, 742A (1952).
		1.49	a	
		3.90	$E_p = 7.4$	
$_{10}Ne^{20}_{10}$	μ	$\leq 2 \times 10^{-4}$	M	G. Weinreich et al., Phys. Rev. 87, 229A (1952).
	Levels		Ne(p,p)	D. B. Cowie et al., Phys. Rev. 87, 304 (1952); 85, 742A (1952).
		1.44	a	
		4.36	$E_p = 7.4$	
$_{11}Na^{23}_{12}$	Level		$Na^{23}(p,p)$	D. B. Cowie et al., Phys. Rev. 87, 304 (1952); 85, 742A (1952).
		3.67	a	
			$E_p = 7.4$	
	Levels		$Na^{23}(p,p)$	H. F. Stoddart, H. E. Gove, Phys. Rev. 87, 238A(1952); 87, 262 (1952).
	2.10	3.70	scin	
	2.37	3.92	$E_p = 7.3$	
	2.69	4.45		
	3.01			
$_{11}Na^{24}_{13}$		(1.38) E2		S. D. Bloom, Phys. Rev. 87, 236A(1952); "Errata," p. 181.
		$\alpha_{pair} = 0.6 \times 10^{-4}$		
		(2.76) E2		
		$\alpha_{pair} = 7.1 \times 10^{-4}$		
$_{13}Al^{26}_{13}$	14 Resonances		$Mg^{25}(p,\gamma)$	L. N. Russell et al., Phys. Rev. 86, 653 (1952).
	0.386 – 1.043			
$_{13}Al^{27}_{14}$	Levels		$Al^{27}(p,p)$	D. B. Cowie et al., Phys. Rev. 87, 304 (1952); 85, 742A(1952).
	1.02	3.32	a	
	2.30	4.48	$E_p = 7.4$	
	2.89			
	Levels		$Al^{27}(p,p)$	H. F. Stoddart, H. E. Gove, Phys. Rev. 87, 238A(1952); 87, 262 (1952).
	0.84	4.00	scin	
	1.01	4.47	$E_p = 7.3$	
	2.23	4.60		
	2.77	4.87		
	3.03	5.43		
	3.71			
$_{15}P^{32}_{17}$	d,p(θ)		$P^{31}(d,p)$	W. C. Parkinson et al., Phys. Rev. 87, 387 (1952).
	l = 2 shows neutron captured in d state			
$_{16}S^{32}_{16}$	Levels		$S^{32}(p,p)$	J. S. Arthur et al., Phys. Rev. 87, 237A (1952); verbal report.
	2.42	5.04	scin	
	3.81	5.81	$E_p = 8$	
	4.32	5.95		
	4.50	5.90		
$_{24}Cr^{48}_{24}$	τ	~23^h		G. Rudstam et al., Phys. Rev. 87, 358 (1952). Fe(340 Mev p); chem.
	p 16.2 ^{d}V			
$_{26}Fe^{55}_{29}$	E_{dis}	0.21	scin	P. R. Bell et al., Science 115, 12(1952); ORNL-1164(1951).
	From continuous γ endpoint			

$_{31}Ga^{65}_{34}$	γ	st	1.05	pair	L. G. Mann, W. E. Meyerhof, Phys. Rev. 87, 202A(1952); **verbal report. Zn(p,n); chem. *Relative intensities; adjusted at this point for comparison with Mukerji and Preiswerk.
		2.7%	1.39?	scin	
		5.4%	1.93		
		8.1%	2.20		
		5.4%	2.41**		
		27.3%*	2.75		
		1.5%	3.21		
		2.7%	3.38		
		1.9%	3.79		
		2.2%	4.29		
		0.5%	4.43		
		0.8%	4.78		
	No γ with E_γ <1.0				
	(>0.8β^+)(γ)**				
	β^+	1.1%*	0.40	sl	A. Mukerji, P. Preiswerk, Helv. Phys. Acta 25, 387 (1952). Zn(6.8 Mev p); chem. *K capture taken as 34%.
		4.5%	0.90		
		2.7%	1.38		
		56.0%	4.15		
	γ	35.0%	1.05	sl;	
		3.2%	1.7	pe^-,	
		4.5%	2.2	Cpt	
		27.3%	2.75		
		4.5%	3.3		
		2.0%	(4.25)		
		2.0%	(4.8)		
	(1.05γ)(2.75γ)				
	No (4.15β^+)(γ)				
$_{31}Ga^{67}_{36}$		I_γ*	E_γ	α_K	A. Mukerji, P. Preiswerk, Helv. Phys. Acta 25, 387 (1952). Zn(6.8 Mev p); chem. *Relative % transitions.
	γ_1	70%	0.092	0.28	
	γ_2	30%	0.182	0.0091	
	γ_3	2%	0.205	0.0055	
	γ_4	18%	0.298	0.0025	
	γ_5	4%	0.388	0.0017	
				sl;ce^-,pe^-	
	γ_1	K/L = 6.5		M1,E2	
	γ_2	K/L = 9		M1	
	(0.092γ)(γ)		γ/X = 2.8		
$_{31}Ga^{68}_{37}$	K	15%(calc)			A. Mukerji, P. Preiswerk, Helv. Phys. Acta 25, 387 (1952). Zn(6.8 Mev p); chem.
	β^+	3%	0.77	sl	
		82%	1.88		
	γ	10%	1.10		

Q's Between Ground States

$H^3(d,n)He^4$	+17.7	± 0.3	P. Norwood, L. Rosen, LAMS-1383(uncl)(1952).
$B^{10}(p,\alpha)Be^7$	+1.147	± 0.003	D. S. Craig et al., Phys. Rev. 87, 206A(1952).
$B^{10}(p,He^3)Be^8$	−0.536	± 0.003	
$O^{16}(p,\alpha)N^{14}$	+3.113	± 0.004	
$N^{14}(d,n)O^{15}$	+5.1		W. B. Rose et al., Phys. Rev. 87, 382(1952).
$C^{13}(\alpha,n)O^{16}$	+2.1	± 0.1	G. A. Jones, D. H. Wilkinson, Proc. Phys. Soc., (London) A64, 756(1951).
$Co^{59}(d,p)Co^{60}$	+5.30		D. C. Hoesterey, Phys. Rev. 87, 216A(1952); verbal report.
$Ni^{58}(d,p)Ni^{61}$	+6.30		
$Cu^{63}(d,p)Cu^{64}$	+5.66		
$Ti^{46}(d,p)Ti^{47}$	+6.45	± 0.05	G. F. Pieper, Phys. Rev. 87, 215A(1952); verbal report.
$Ti^{47}(d,p)Ti^{48}$	+8.14	± 0.05	
$Ti^{48}(d,p)Ti^{49}$	+5.81	± 0.04	
$Ti^{49}(d,p)Ti^{50}$	+8.62	± 0.05	
$Ti^{50}(d,p)Ti^{51}$	+4.11	± 0.07	